FERC/DEIS-0045

BLM LIBRARY
88067007

MOJAVE-KERN RIVER-EL DORADO
Natural Gas Pipeline Projects

Draft Environmental Impact Report/Statement

VOLUME II

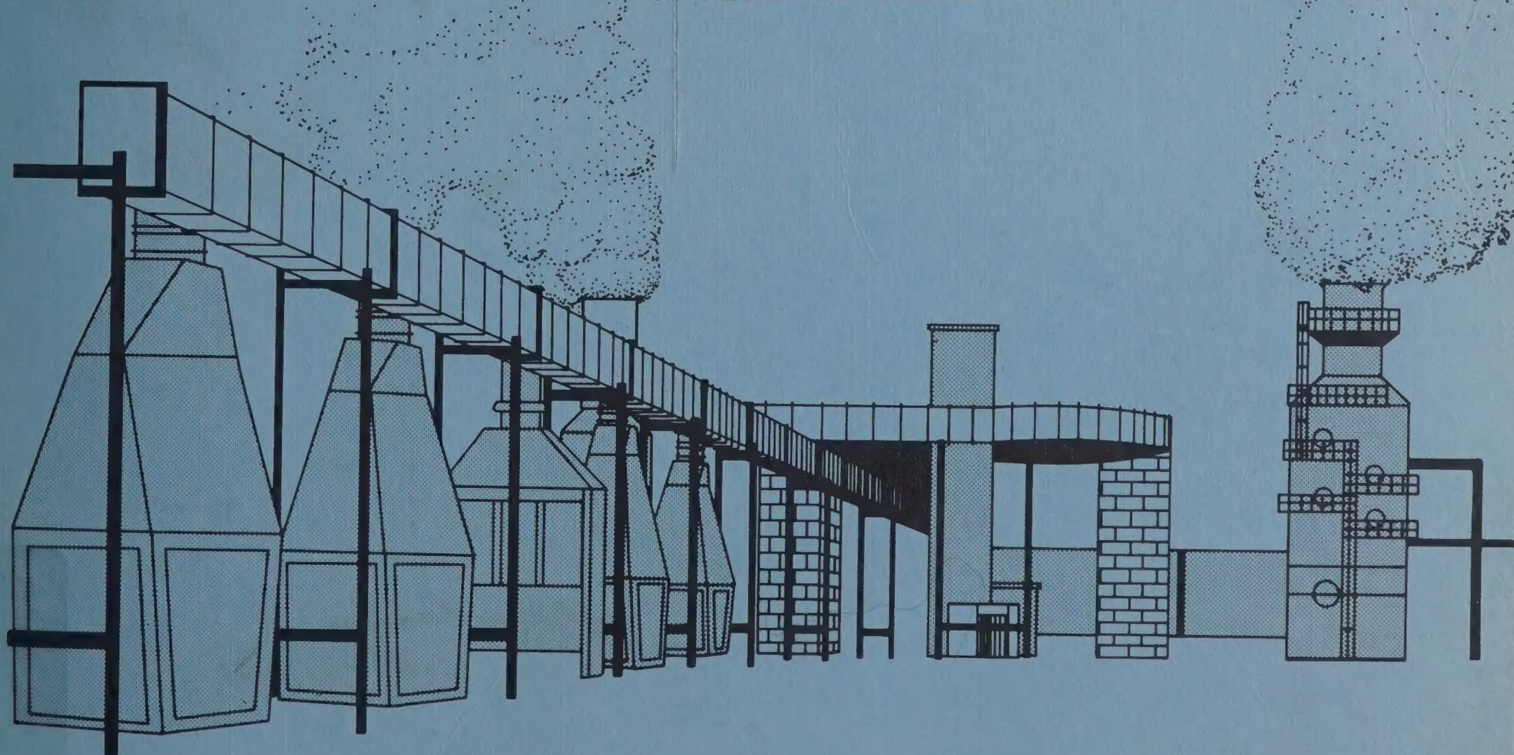
Kern River

BUREAU OF LAND MGMT
ELY, NEVADA
RECEIVED
JAN 27 1987

RT	OFFICE	INIT	DATE
	DM		
	RES		
	OPS		
	ADM		
✓	EGN	SN	1/27
✓	SCH	DR	1/21
	C. F.		

Comments:

CALIFORNIA STATE LANDS COMMISSION
FEDERAL ENERGY REGULATORY COMMISSION



January 1987

CGI

#21835221

ID 88067007

TD
194.5
.M64
1987b
v.2

MOJAVE-KERN RIVER-EL DORADO

Natural Gas Pipeline Projects

Draft Environmental Impact Report/Statement

January 1987

VOLUME II

Kern River

CALIFORNIA STATE LANDS COMMISSION
1807 13th Street
Sacramento, California 95814

and

FEDERAL ENERGY REGULATORY COMMISSION
825 North Capitol Street
Washington, D.C. 20426

CGI
CHAMBERS GROUP, INC.

MOJAVE-KERN RIVER-EL DORADO NATURAL GAS PIPELINE PROJECT DRAFT EIR/EIS

MASTER TABLE OF CONTENTS

VOLUME I - Mojave, El Dorado, El Paso, and Transwestern

SUMMARY
CHAPTER 1 INTRODUCTION
CHAPTER 2 DESCRIPTION OF PROPOSED PROJECTS
CHAPTER 3 AFFECTED ENVIRONMENT
CHAPTER 4 ENVIRONMENTAL CONSEQUENCES
CHAPTER 5 CEQA ALTERNATIVES

VOLUME II - Kern River

CHAPTER 1 INTRODUCTION
CHAPTER 2 DESCRIPTION OF PROPOSED PROJECTS
CHAPTER 3 AFFECTED ENVIRONMENT
CHAPTER 4 ENVIRONMENTAL CONSEQUENCES
CHAPTER 5 CEQA ALTERNATIVES
REFERENCES
GLOSSARY
ABBREVIATIONS
LIST OF PREPARERS

Volume I Appendices
Appendix A Characteristics of the Soil Mapping Units
Appendix B Vegetation Community Types
Appendix C Plant Species of Special Concern
Appendix D A Summary of Grazing Allotments
Appendix E-1 Plant Species List
Appendix E-2 Common Scientific Names for Wildlife Species

Volume II Appendices
Appendix A Characteristics of the Soil Mapping Units
Appendix B Vegetation Community Types
Appendix C Plant Species of Special Concern
Appendix D A Summary of Grazing Allotments
Appendix E-1 Plant Species List
Appendix E-2 Common Scientific Names for Wildlife Species
Appendix F Energy Transportation and Utility Corridor Planning Direction

VOLUME III - Comparisons and Recommendations

CHAPTER 1 INTERSTATE SYSTEMS COMPARATIVE ANALYSES
CHAPTER 2 INTRASTATE SYSTEM ALTERNATIVES COMPARISON ANALYSES
CHAPTER 3 CONCLUSIONS AND RECOMMENDATIONS

VOLUME IV - Maps

VOLUME II

TABLE OF CONTENTS

Section	Title	Page
	Table of Contents	i
	List of Tables	xii
	List of Figures	xvii
1.0	INTRODUCTION	1-1
2.0	DESCRIPTION OF PROPOSED PROJECTS	2-1
2.1	Introduction	2-1
2.2	Kern River Proposal	2-1
2.2.1	Facilities	2-1
2.2.2	Construction, Operation and Maintenance	2-7
2.2.2.1	Pipeline Construction Methods	2-7
2.2.2.2	Construction Workforce and Schedule	2-8
2.2.3	Environmental and Safety Controlds	2-9
2.2.4	Future Plans and Abandonment	2-9
2.3	Northwest Proposal	2-9
2.3.1	Facilities	2-9
2.3.2	Construction, Operation, and Maintenance	2-10
2.3.3	Environmental and Safety Controls	2-10
2.3.4	Future Plans and Abandonment	2-10
2.4	Kern River Route Variations	2-10
2.4.1	Wasatch Variation	2-10
2.4.2	West Strawberry Variation	2-11
2.4.3	Salt Creek Canyon Variation	2-12
2.4.4	North Las Vegas Variation with the Goodsprings Spur	2-12
2.4.5	Henderson Variation	2-13
2.4.6	North Bakersfield Variation	2-13
2.5	System Alternatives to Kern River	2-15
2.5.1	Mojave Proposal and Alternatives to Mojave	2-15
2.5.2	El Dorado Proposal	2-15
2.5.3	East Las Vegas/Integrated Intrastate System Alternative	2-15
2.5.4	East Las Vegas/Integrated Intrastate System Alternative withthe Wasatch Variation	2-16
2.5.5	Northwest/PGT/Integrated Intrastate System Alternative	2-16
2.6	No Action Project Alternative	2-17
2.6.1	Status Quo Scenario	2-17
2.6.2	Intrastate Alternative Systems	2-17
2.7	Route Variations and System Alternatives Considered but Eliminated from Detailed Analysis	2-17
2.7.1	Systems Flexibility (E-1)	2-17
2.7.1.1	Mountain Fuel Resources/Overthrust Alternative	2-27
2.7.1.2	East Utah Alternatives	2-29

TABLE OF CONTENTS (continued)

Section	Title	Page
2.7	ROUTE VARIATIONS AND SYSTEM ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS	2-17
2.7.1	Systems Flexibility (E-1)	2-17
2.7.1.1	Mountain Fuel Resources/Overthrust Alternative	2-27
2.7.1.2	East Utah Alternatives	2 -
292.7.2	Economic Feasibility (E-2)	2-30
2.7.2.1	West Salt Lake Alternative	2-31
2.7.2.2	Central Nevada Alternative	2-31
2.7.2.3	Northern Systems Alternative B	2-32
2.7.2.4	Southern Systems B Alternative	2-33
2.7.3	Economic Feasibility (E-3)	2-34
2.7.3.1	East Utah Alternative with Kern River Building Along the Pines or Nephi Routes	2-34 2-32
2.7.3.2	Northern Systems Alternative A	2-35
2.7.3.3	Chevron Oil Variations	2-35
2.7.4	Environmental and Economic Concerns (E-4)	2-36
2.7.4.1	Sage Junction Alternative	2-36
2.7.4.2	East Utah Alternative with Kern River Building Along the Newcastle Route	2-38
2.7.4.3	Weber River Variation	2-40
2.7.4.4	Sevier-Escalante Desert Variation	2-41
2.7.4.5	Intermountain Power Project (IPP) North Delta Variation	2-42
2.7.4.6	IPP/South Delta Variation	2-43
2.7.4.7	Sanpete Valley Variation	2-44
2.7.5	Environmental Concerns (E-5)	2-45
2.7.5.1	North Las Vegas Variation with the California Spur	2-45
2.7.5.2	Sunrise Mountain Variations	2-46
2.7.5.3	Tejon Canyon Variation	2-48
2.7.6	Environmental Comparison of Alternatives (E-6)	2-48
2.7.6.1	Southern Systems A Alternative	2-49
2.7.6.2	North-South System Alternatives	2-54
2.8	INTERRELATIONSHIP WITH OTHER PLANNED OR PROPOSED PROJECTS	2-57
3.0	AFFECTED ENVIRONMENT	3-1
3.1	KERN RIVER PROPOSAL	3-1
3.1.1	Air Quality	3-1
3.1.2	Geology	3-5
3.1.2.1	Wyoming Basin (MP 0-70)	3-5
3.1.2.2	Middle Rocky Mountains (MP 70-185)	3-9

TABLE OF CONTENTS (continued)

Section	Title	Page
3.1.2.3	Basin and Range (MP 185-535)	3-11
3.1.2.4	Mojave Desert/Tehachapi Mountains/ San Joaquin Valley Portion (MP 535-756)	3-12
3.1.2.5	Kern River Lateral	3-15
3.1.2.6	Taft Lateral	3-16
3.1.3	Soil	3-16
3.1.3.1	Kern River Mainline	3-16
3.1.3.2	Taft Lateral	3-19
3.1.3.3	Kern River Lateral	3-19
3.1.3.4	Compressor Stations	3-19
3.1.4	Surface Water	3-19
3.1.4.1	Wyoming Basin	3-20
3.1.4.2	Middle Rocky Mountains Region	3-20
3.1.4.3	Basin and Range Region	3-25
3.1.4.4	Mojave Desert Region	3-25
3.1.4.5	Tehachapi Mountains	3-25
3.1.4.6	San Joaquin Valley	3-26
3.1.5	Groundwater	3-26
3.1.6	Freshwater Biology	3-28
3.1.6.1	Wyoming Basin (MP 0-40)	3-28
3.1.6.2	Middle Rocky Mountains (MP 40-185)	3-31
3.1.6.3	Basin and Range (MP 185-390)	3-32
3.1.6.4	Mojave Desert (MP 390-713.5	3-33
3.1.6.5	Tehachapi Mountains and San Joaquin Valley (MP 713.5-756)	3-33
3.1.7	Terrestrial Biology	3-34
3.1.7.1	Vegetation	3-34
3.1.7.2	Wildlife	3-41
3.1.7.3	Grazing	3-56
3.1.8	Socioeconomics	3-56
3.1.8.1	Population, Housing, and Economic Characteristics	3-62
3.1.8.2	Traffic	3-65
3.1.8.3	Noise	3-67
3.1.8.4	Recreational Resources	3-68
3.1.9	Land Ownership/Use	3-70
3.1.9.1	Mainline	3-70
3.1.9.2	Kern River Lateral	3-79
3.1.9.3	Taft Lateral	3-79
3.1.10	Cultural Resources	3-80
3.1.10.1	Archaeology	3-80
3.1.10.2	American Indian Concerns	3-85
3.1.11	Paleontological Resources	3-87
3.1.12	Visual Resources	3-87
3.3	NORTHWEST PROPOSAL	3-93

TABLE OF CONTENTS (continued)

Section	Title	Page
3.4	KERN RIVER ROUTE VARIATIONS	3-93
3.4.1	Wasatch Variation	3-93
3.4.1.2	Geology	3-93
3.4.1.3	Soil	3-96
3.4.1.4	Surface Water	3-97
3.4.1.5	Groundwater	3-99
3.4.1.6	Freshwater Biology	3-99
3.4.1.7	Terrestrial Biology	3-99
3.4.1.8	Socioeconomics	3-104
3.4.1.9	Land Ownership/Use	3-106
3.4.1.10	Cultural Resources	3-108
3.4.1.11	Paleontological Resources	3-109
3.4.1.12	Visual Resources	3-110
3.4.2	West Strawberry Variation	3-110
3.4.2.2	Geology	3-110
3.4.2.3	Soil	3-112
3.4.2.4	Surface Water	3-112
3.4.2.5	Groundwater	3-112
3.4.2.6	Freshwater Biology	3-113
3.4.2.7	Terrestrial Biology	3-115
3.4.2.8	Socioeconomics	3-117
3.4.2.9	Land Ownership/Use	3-119
3.4.2.10	Cultural Resources	3-120
3.4.2.11	Paleontological Resources	3-121
3.4.2.12	Visual Resources	3-122
3.4.3	Salt Creek Canyon Variation	3-122
3.4.3.2	Geology	3-123
3.4.3.3	Soil	3-123
3.4.3.4	Surface Water	3-123
3.4.3.5	Groundwater	3-124
3.4.3.6	Freshwater Biology	3-124
3.4.3.7	Terrestrial Biology	3-124
3.4.3.8	Socioeconomics	3-125
3.4.3.9	Land Ownership/Use	3-126
3.4.3.10	Cultural Resources	3-127
3.4.3.11	Paleontological Resources	3-127
3.4.3.12	Visual Resources	3-127
3.4.4	North Las Vegas Variation (Goodsprings Spur)	3-127
3.4.4.2	Geology	3-128
3.4.4.3	Soil	3-129
3.4.4.4	Surface Water	3-129
3.4.4.5	Groundwater	3-130
3.4.4.6	Freshwater Biology	3-130
3.4.4.7	Terrestrial Biology	3-130
3.4.4.8	Socioeconomics	3-132
3.4.4.9	Land Ownership/Use	3-133
3.4.4.10	Cultural Resources	3-135
3.4.4.11	Paleontological Resources	3-136
3.4.4.12	Visual Resources	3-136

TABLE OF CONTENTS (continued)

Section	Title	Page
3.4.5	Henderson Variation	3-137
3.4.5.2	Geology	3-137
3.4.5.3	Soil	3-137
3.4.5.4	Surface Water	3-137
3.4.5.5	Groundwater	3-137
3.4.5.6	Freshwater Biology	3-138
3.4.5.7	Terrestrial Biology	3-138
3.4.5.8	Socioeconomics	3-139
3.4.5.9	Land Ownership/Use	3-139
3.4.5.10	Cultural Resources	3-139
3.4.5.11	Paleontological Resources	3-140
3.4.5.12	Visual Resources	3-140
3.4.6	North Bakersfield Variation	3-140
3.4.6.2	Geology	3-140
3.4.6.3	Soil	3-142
3.4.6.4	Surface Water	3-143
3.4.6.5	Groundwater	3-143
3.4.6.6	Freshwater Biology	3-143
3.4.6.7	Terrestrial Biology	3-143
3.4.6.8	Socioeconomics	3-147
3.4.6.9	Land Ownership/Use	3-148
3.4.6.10	Cultural Resources	3-149
3.4.6.11	Paleontological Resources	3-150
3.4.6.12	Visual Resources	3-151
3.5.1	East Las Vegas/Intrastate System Alternative	3-151
3.5.1.1	Air Quality	3-151
3.5.1.2	Geology	3-151
3.5.1.3	Soil	3-153
3.5.1.4	Surface Water	3-153
3.5.6.5	Groundwater	3-153
3.5.1.6	Freshwater Biology	3-153
3.5.1.7	Terrestrial Biology	3-153
3.5.1.8	Socioeconomics	3-155
3.5.1.9	Land Ownership/Use	3-156
3.5.1.10	Cultural Resources	3-157
3.5.1.11	Paleontological Resources	3-159
3.5.1.12	Visual Resources	3-160
3.5.2	East Las Vegas Alternative with the Wasatch Varation	3-160
3.5.3	Northwest/PGT/Integrated System Alternative	3-160
4.0	ENVIRONMENTAL CONSEQUENCES	4-1
4.1	INTRODUCTION	4-1
4.2	KERN RIVER PROPOSAL	4-1
4.2.1	Air Quality	4-1
4.2.1.1	Project Emissions	4-2

TABLE OF CONTENTS (continued)

Section	Title	Page
4.2.1.2	Installation/Construction Impacts	4-3
4.2.1.3	Operational Phase Impacts	4-4
4.2.1.4	Visibility Impact Analysis	4-4
4.2.2	Geology	4-4
4.2.2.1	Seismicity and Faulting	4-10
4.2.2.3	Slope Stability	4-11
4.2.2.4	Subsidence	4-13
4.2.2.5	Flash Floods and Debris Flows	4-13
4.2.2.6	Volcanics	4-13
4.2.2.7	Avalanches	4-14
4.2.2.8	Mineral/Petroleum Resources	4-14
4.2.3	Soil	4-14
4.2.3.1	Kern River Mainline	4-16
4.2.3.2	Kern River Lateral	4-18
4.2.3.3	Taft Lateral	4-18
4.2.3.4	Compressor Stations	4-18
4.2.4	Surface Water	4-19
4.2.4.1	Kern River Mainline	4-21
4.2.5	Groundwater	4-25
4.2.5.1	Kern River Mainline	4-26
4.2.6	Freshwater Biology	4-28
4.2.6.1	Wyoming Basin	4-31
4.2.6.2	Middle Rocky Mountains	4-31
4.2.6.3	Basin and Range	4-31
4.2.6.4	Mojave Desert	4-31
4.2.6.5	Tehachapi Mountains and San Joaquin Valley	4-32
4.2.7	Terrestrial Biology	4-32
4.2.7.1	Vegetation	4-32
4.2.7.2	Wildlife	4-42
4.2.7.3	Grazing	4-56
4.2.8	Socioeconmics	4-57
4.2.8.1	Population, Housing and Economic Impacts	4-57
4.2.8.2	Traffic	4-63
4.2.8.3	Noise	4-64
4.2.8.4	Recreational Resources	4-65
4.2.9	Land Ownership/Use	4-66
4.2.9.1	Kern River Mainline	4-69
4.2.9.2	Kern River Lateral	4-69
4.2.9.3	Taft Lateral	4-69
4.2.10	Cultural Resources	4-69
4.2.10.1	Archaeology	4-69
4.2.10.2	American Indian Concerns	4-72
4.2.11	Paleontological Resources	4-73
4.2.12	Visual Resources	4-74
4.2.13	Systems Safety and Reliability	4-93

TABLE OF CONTENTS (continued)

Section	Title	Page
4.3	NORTHWEST PROPOSAL	4-93
4.4	KERN RIVER ROUTE VARIATIONS	4-96
4.4.1	Wasatch Variation	4-96
4.4.1.1	Air Quality	4-96
4.4.1.2	Geology	4-96
4.4.1.3	Soil	4-99
4.4.1.4	Surface Water	4-101
4.4.1.5	Groundwater	4-102
4.4.1.6	Freshwater Biology	4-102
4.4.1.7	Terrestrial Biology	4-103
4.4.1.8	Socioeconomics	4-107
4.4.1.9	Land Ownership/Use	4-109
4.4.1.10	Cultural Resources	4-109
4.4.1.11	Paleontological Resources	4-109
4.4.1.12	Visual Resources	4-112
4.4.1.13	Systems Safety and Reliability	4-112
4.4.2	West Strawberry Variation	4-117
4.4.2.1	Air Quality	4-117
4.4.2.2	Geology	4-117
4.4.2.3	Soil	4-119
4.4.2.4	Surface Water	4-119
4.4.2.5	Groundwater	4-121
4.4.2.6	Freshwater Biology	4-121
4.4.2.7	Terrestrial Biology	4-122
4.4.2.8	Socioeconomics	4-125
4.4.2.9	Land Ownership/Use	4-126
4.4.2.10	Cultural Resources	4-129
4.4.2.11	Paleontological Resources	4-129
4.4.2.12	Visual Resources	4-129
4.4.2.13	Systems Safety and Reliability	4-134
4.4.3	Salt Creek Canyon Variation	4-136
4.4.3.1	Air Quality	4-136
4.4.3.2	Geology	4-136
4.4.3.3	Soil	4-136
4.4.3.4	Surface Water	4-137
4.4.3.5	Groundwater	4-137
4.4.3.6	Freshwater Biology	4-137
4.4.3.7	Terrestrial Biology	4-139
4.4.3.8	Socioeconomics	4-140
4.4.3.9	Land Ownership/Use	4-140
4.4.3.10	Cultural Resources	4-141
4.4.3.11	Paleontological Resources	4-141
4.4.3.13	System Safety and Reliability	4-141
4.4.4	North Las Vegas Variation with the Goodsprings Spur	4-142
4.4.4.1	Air Quality	4-142
4.4.4.2	Geology	4-142
4.4.4.3	Soil	4-143
4.4.4.4	Surface Water	4-143

TABLE OF CONTENTS (continued)

Section	Title	Page
4.4.4.5	Groundwater	4-143
4.4.4.6	Freshwater Biology	4-143
4.4.4.7	Terrestrial Biology	4-145
4.4.4.8	Socioeconomics	4-147
4.4.4.9	Land Ownership/Use	4-147
4.4.4.10	Cultural Resources	4-148
4.4.4.11	Paleontological Resources	4-149
4.4.4.13	System Safety and Reliability	4-149
4.4.5	Henderson Variation	4-149
4.4.5.1	Air Quality	4-149
4.4.5.2	Geology	4-150
4.4.5.3	Soil	4-150
4.4.5.4	Surface Water	4-152
4.4.5.5	Groundwater	4-152
4.4.5.7	Terrestrial Biology	4-152
4.4.5.8	Socioeconomics	4-153
4.4.5.9	Land Ownership/Use	4-153
4.4.5.10	Cultural Resources	4-154
4.4.5.11	Paleontological Resources	4-154
4.4.5.12	Visual Resources	4-154
4.4.5.13	System Safety and Reliability	4-155
4.4.6	North Bakersfield Variation	4-155
4.4.6.1	Air Quality	4-155
4.4.6.2	Geology	4-155
4.4.6.3	Soil	4-156
4.4.6.4	Surface Water	4-156
4.4.6.5	Groundwater	4-156
4.4.6.6	Freshwater Biology	4-158
4.4.6.7	Terrestrial Biology	4-158
4.4.6.8	Socioeconomics	4-164
4.4.6.9	Land Ownership/Use	4-165
4.4.6.10	Cultural Resources	4-165
4.4.6.11	Paleontological Resources	4-166
4.4.6.12	Visual Resources	4-166
4.4.6.13	System Safety and Reliability	4-166
4.5.1	East Las Vegas System Alternative	4-166
4.5.1.1	Air Quality	4-167
4.5.1.2	Geology	4-167
4.5.1.3	Soil	4-168
4.5.1.4	Surface Water	4-168
4.5.1.5	Groundwater	4-168
4.5.1.6	Freshwater Biology	4-168
4.5.1.7	Terrestrial Biology	4-170
4.5.1.8	Socioeconomics	4-172
4.5.1.9	Land Ownership/Use	4-173
4.5.1.10	Cultural Resources	4-174
4.5.1.11	Paleontological Resources	4-175
4.5.1.12	Visual Resources	4-175
4.5.1.13	Systems Safety and Reliability	4-175

TABLE OF CONTENTS (continued)

Section	Title	Page
4.5.2	East Las Vegas Alternative with the Wasatch Variation	4-175
4.5.3	Northwest/PGT/Integrated Intrastate System Alternative	4-176
4.6	CUMULATIVE IMPACTS	4-176
4.7	PLANNED AND ADDITIONAL MITIGATION MEASURES	4-179
4.7.1	Kern River Mitigation Measures	4-180
4.7.1.1	Air Quality	4-180
4.7.1.2	Geology	4-181
4.7.1.3	Soil	4-184
4.7.1.4	Surface Water	4-186
4.7.1.5	Groundwater	4-192
4.7.1.6	Freshwater Biology	4-192
4.7.1.7	Terrestrial Biology	4-194
4.7.1.8	Socioeconomics	4-205
4.7.1.9	Land Ownership/Use	4-206
4.7.1.10	Cultural Resources	4-207
4.7.1.11	Paleontological Resources	4-210
4.7.1.12	Visual Resources	4-212
4.7.1.13	System Safety and Reliability	4-215
4.8	UNAVOIDABLE ADVERSE IMPACTS	4-216
4.8.1	Kern River Proposal	4-216
4.8.1.1	East Las Vegas System Alternative	4-216
4.8.1.2	East Las Vegas System Alternative with the Wasatch Variation	4-216
4.8.1.3	Northwest/PGT/Integrated Intrastate System Alternative	4-216
4.9	RELATIONSHIPS BETWEEN SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY	4-219
4.10	IRREVERSIBLE/IRRETRIEVABLE COMMITMENT OF RESOURCES	4-219
4.11	GROWTH INDUCING IMPACTS	4-219
5.0	CEQA ALTERNATIVES	5-1
5.1	ALTERNATIVE SOURCES OF NATURAL GAS	5-1
5.2	ALTERNATIVE METHODS FOR ENHANCED OIL RECOVERY	5-1
5.3	ALTERNATIVE FUELS FOR ENHANCED OIL RECOVERY	5-2

TABLE OF CONTENTS (continued)

Section Title Page

5.4 ALTERNATIVE PIPELINE ROUTES 5-2

5.5 ALTERNATIVE AIR POLLUTION CONTROLS 5-2

REFERENCES CITED R-1
GLOSSARY G-1
ABBREVIATIONS
LIST OF PREPARERS

VOLUME I APPENDICES

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS
  Mojave Pipeline Proposal A-1
  El Dorado Pipeline Proposal A-8
  El Paso Base Case A-15
  El Paso 600 MMcfd Alternatives A-16
  Northwest Expansion Project A-22
  Transwestern Expansion Proposal A-29

APPENDIX B VEGETATION COMMUNITY TYPE DESCRIPTION B-1

APPENDIX C PLANT SPECIES OF SPECIAL CONCERN
C-1 Mojave Pipeline Proposal C-1
C-2 El Dorado Pipeline Proposal C-8
C-3a El Paso Base Case C-15
C-3b Northwest Expansion Project C-17
C-4 Transwestern Expansion Project C-18

APPENDIX D A SUMMARY OF GRAZING ALLOTMENTS
D-1 Mojave Pipeline Proposal D-1
D-2 El Dorado Pipeline Proposal D-2
D-3a El Paso Base Case D-3
D-3b El Paso 600 MMcfd Alternatives D-4
D-3c Northwest Expansion Project D-5
D-4 Transwestern Expansion Proposal D-6

APPENDIX E-1 PLANT SPECIES LIST E-1
APPENDIX E-2 COMMON SCIENTIFIC NAMES FOR WILDLIFE SPECIES

VOLUME II APPENDICES

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS A-1

APPENDIX B VEGETATION COMMUNITY TYPE DESCRIPTION B-1

APPENDIX C PLANT SPECIES OF SPECIAL CONCERN C-1

TABLE OF CONTENTS (continued)

Section	Title	Page
APPENDIX D	A SUMMARY OF GRAZING ALLOTMENTS	D-1
APPENDIX E-1	PLANT SPECIES LIST	E-1
APPENDIX E-2	COMMON SCIENTIFIC NAMES FOR WILDLIFE SPECIES	
APPENDIX F	ENERGY TRANSPORTATION AND UTILITY CORRIDOR PLANNING DIRECTION	F-1

VOLUME II LIST OF TABLES

Table	Title	Page
2.2-1	Geographical Dristribution of Facilities, Kern River Proposal	2-3
2.2-2	Preliminary Microwave Site Locations	2-6
2.2-3	Potential Water Sources for Hydrostatic Testing	2-8
2.6-1	Kern River Gas Transmission Company Proposal and Eliminated Alternatives	2-20
3.1-1	Summary of Ambient Air Quality Standards	3-2
3.1-2	Summary of Relevant Air Quality in Nevada	3-3
3.1-3	Summary of Relevant Air Quality in Utah	3-4
3.1-4	Summary of Relevant Air Quality in Wyoming	3-5
3.1-5	Geologic and Physiographic Conditions, Kern River Proposal	3-6
3.1-6	Active and Potentially Active Faults, Kern River Proposal	3-13
3.1-7	Major Drainage Channels, Kern River Proposal	3-21
3.1-8	General Groundwater Characteristics, Kern River Proposal	3-27
3.1-9	Fishery Value of Major Perennial Streams, Kern River Proposal	3-29
3.1-10	Typical Fish Species of Perennial Streams, Middle Rocky Mountains Region	3-31
3.1-11	Occurrence of Sensitive Fish Species, Kern River Proposal	3-32
3.1-12	Potential Fish Species, Basin and Range Region	3-33
3.1-13	Vegetation Community Types, Kern River Proposal	3-35
3.1-14	Legally Protected Plant Species, Kern River Proposal	3-38
3.1-15	Important Wildlife Habitat Features, Kern River Proposal	3-41
3.1-16	Wildlife Species of Special Concern, Kern River Proposal	3-44
3.1-17	Population and Housing Characteristics of Affected Counties, Kern River Proposal	3-57
3.1-18	Industrial Structure and Salient Economic Characteristics, Kern River Proposal	3-59
3.1-19	Socioeconomic Characteristics of Selected Cities, Kern River Proposal	3-61
3.1-20	Transportation Corridor Crossings, Kern River Proposal	3-66
3.1-21	Relationship Between Population Density and Average Day-Night Noise Levels, Kern River Proposal	3-67
3.1-22	Land Ownership, Kern River Proposal	3-71
3.1-23	Land Use, Kern River Proposal	3-72
3.1-24	Federal, State, and County Land Use Regulations and Policies, Kern River Proposal	3-73

LIST OF TABLES (continued)

Table	Title	Page
3.1-25	Wilderness Study Areas, Kern River Proposal	3-78
3.1-26	Known Cultural Resource Sites, Kern River Proposal	3-81
3.1-27	Known Cultural Resources Types, Kern River Proposal	3-82
3.1-28	Paleontological Formations, Kern River Proposal	3-88
3.3-1	Geologic and Physiographic Conditions, Wasatch Variation	3-94
3.3-2	Major Drainage Channels, Wasatch Variation	3-97
3.3-3	Fishery Value of Major Perennial Streams, Wasatch Variation	3-100
3.3-4	Vegetation Community Types, Wasatch Variation	3-101
3.3-5	Important Wildlife Habitat Features, Wasatch Variation	3-103
3.3-6	Transportation Corridor Crossings, Wasatch Variation	3-105
3.3-7	Land Ownership, Wasatch Variatiron	3-107
3.3-8	Land Use, Wasatch Variation	3-107
3.3-9	Paleontological Formations, Wasatch Variation	3-109
3.3-10	Geologic and Physiographic Conditions, West Strawberry Variation	3-111
3.3-11	Major Drainage Channels, West Strawberry Variation	3-113
3.3-12	Fishery Value of Major Perennial Streams, West Strawberry Variation	3-114
3.3-13	Vegetation Community Types, West Strawberry Variation	3-115
3.3-14	Important Wildlife Habitat Features, West Strawberry Variation	3-117
3.3-15	Transportation Corridor Crossings, West Strawberry Variation	3-118
3.3-16	Land Ownership, West Strawberry Variation	3-120
3.3-17	Land Use, West Strawberry Variation	3-120
3.3-18	Paleontological Formations, West Strawberry Variation	3-121
3.3-19	Geologic and Physiographic Conditions, Salt Creek Canyon Variation	3-123
3.3-20	Land Ownership, Salt Creek Canyon Variation	3-126
3.3-21	Land Use, Salt Creek Canyon Variation	3-126
3.3-22	Geologic and Physiographic Conditions, North Las Vegas Variation	3-128
3.3-23	Major Drainage Channels, North Las Vegas Variation	3-129
3.3-24	Vegetation Community Types, North Las Vegas Variation	3-131
3.3-25	Transportation Corridor Crossings, North Las Vegas Variation	3-133

LIST OF TABLES (continued)

Table	Title	Page
3.3-26	Land Ownership, North Las Vegas Variation	3-134
3.3-27	Land Use, North Las Vegas Variation	3-135
3.3-28	Paleontological Formations, North Las Vegas Variation	3-136
3.3-29	Geologic and Physiographic Conditions, North Bakersfield Variation	3-141
3.3-30	Major Drainage Channels, North Bakersfield Variation	3-144
3.3-31	Vegetation Community Types, North Bakersfield Variation	3-145
3.3-32	Transportation Corridor Crossings, North Bakersfield Variation	3-148
3.3-33	Land Ownership, North Bakersfield Variation	3-149
3.3-34	Land Use, North Bakersfield Variation	3-149
3.3-35	Paleontological Formations, North Bakersfield Variation	3-150
3.4-1	Geologic and Physiographic Conditions, East Las Vegas Alternative	3-152
3.4-2	Vegetation Community Types, East Las Vegas Alternative	3-154
3.4-3	Transportation Corridor Crossings, East Las Vegas Alternative	3-155
3.4-5	Land Ownership, East Las Vegas Alternative	3-157
3.4-6	Land Use, East Las Vegas Alternative	3-157
3.4-7	Paleontological Formations, East Las Vegas Alternative	3-159
4.2-1	Total Estimated Construction Emissions within California, Kern River Proposal	4-2
4.2-2	Worst-Hour Air Quality Emission Estimates, Kern River Proposal Compressor Stations	4-3
4.2-3	Air Quality Construction Impacts through S.E. Desert Air Basin, Ca, Kern River Proposal	4-5
4.2-4	Air Quality Construction Impacts through Kern County, Ca, Kern River Proposal	4-6
4.2-5	Worst-Hour and Annual Operations, Air Quality Impacts, Kern River Compressor Station #1 (SW Wyoming)	4-7
4.2-6	Worst-Hour and Annual Operations, Air Quality Impacts, Kern River Compressor Station #3 (Central UT)	4-8
4.2-7	Worst-Hour and Annual Operations, Air Quality Impacts, Kern River Compressor Station #5 (Southern Nevada)	4-9
4.2-8	Significant Geological Hazards, Kern River Proposal	4-12
4.2-9	Distribution of Potential Soil Impacts, Kern River Proposal	4-17
4.2-10	Potential Groundwater Impacts, Kern River Proposal	4-27

LIST OF TABLES (continued)

Table	Title	Page
4.2-11	Significance of Impacts on Aquatic Communities, Kern River Proposal	4-29 4-24
4.2-12	Vegetation Types and Denuded Acreages, Kern River Proposal	4-35
4.2-13	Significant Wildlife Impacts, Kern River Proposal	4-45
4.2-14	Summary of Wildlife Impacts, Kern River Proposal	4-54
4.2-15	Aggregate Socioeconomic Impact Information, Kern River Proposal	4-59
4.2-16	Contribution to County Tax Base, Kern River Proposal	4-61
4.2-17	Housing Demand Distribution by Affected Area, Kern River Proposal	4-62
4.2-18	Construction and Operation Disturbance by Land Ownership, Kern River Proposal	4-67
4.2-19	Construction and Operation Disturbance by Land Use, Kern River Proposal	4-68
4.2-20	Visual Impact Criteria, Kern River Proposal	4-75
4.2-21	Summary of Visual Impacts, Kern River Proposal	4-76
4.2-22	Analysis of Potential Vulnerable Resources and Geological Hazards, Kern River Proposal	4-95
4.4-1	Significant Geological Hazards, Wasatch Variation	4-97
4.4-2	Distribution of Potential Soils Impacts, Wasatch Variation	4-100
4.4-3	Significance of Impacts on Aquatic Communities, Wasatch Variation	4-102
4.4-4	Vegetation Types and Denuded Acreages, Wasatch Variation	4-104
4.4-5	Significant Wildlife Impacts, Wasatch Variation	4-106
4.4-6	Construction and Operation Disturbance by Land Ownership, Wasatch Variation	4-110
4.4-7	Construction and Operation Disturbance by Land Use, Wasatch Variation	4-111
4.4-8	Summary of Visual Impacts, Wasatch Variation	4-113
4.4-9	Distribution of Potential Soils Impacts, West Strawberry Variation	4-120
4.4-10	Significance of Impacts on Aquatic Communities, West Strawberry Variation	4-121 4-120
4.4-11	Vegetation Types and Denuded Acreages, West Strawberry Variation	4-123
4.4-12	Significant Wildlife Impacts, West Strawberry Variation	4-124
4.4-13	Construction and Operation Disturbance by Land Ownership, West Strawberry Variation	4-127
4.4-14	Construction and Operation Disturbance by Land Use, West Strawberry Variation	4-128

LIST OF TABLES (continued)

Table	Title	Page
4.4-15	Summary of Visual Impacts, West Strawberry Variation	4-130
4.4-16	Distribution of Potential Soils Impacts, Salt Creek Canyon Variation	4-138
4.4-17	Construction and Operation Disturbance by Land Ownership, Salt Creek Canyon Variation	4-140
4.4-18	Construction and Operation Disturbance by Land Use, Salt Creek Canyon Variation	4-141
4.4-19	Distribution of Potential Soils Impacts Along the North Las Vegas Variation	4-144
4.4-20	Vegetation Types and Denuded Acreages, North Las Vegas Variation	4-146
4.4-21	Construction and Operation Disturbance by Land Ownership, North Las Vegas Variation	4-148
4.4-22	Construction and Operation Disturbance by Land Use, North Las Vegas Variation	4-148
4.4-23	Distribution of Potential Soils Impacts, Henderson Variation	4-151
4.4-24	Construction and Operation Disturbance by Land Ownership, Henderson Variation	4-154
4.4-25	Construction and Operation Disturbance by Land Use, Henderson Variation	4-154
4.4-26	Distribution of Potential Soils Impacts, North Bakersfield Variation	4-157
4.4-27	Vegetation Types and Denuded Acreages, North Bakersfield Variation	4-159
4.4-28	Construction and Operation Disturbance by Land Ownership, North Bakersfield Variation	4-165
4.4-29	Construction and Operation Disturbance by Land Use, North Bakersfield Variation	4-165
4.5-1	Distribution of Potential Soils Impacts, East Las Vegas System Alternative	4-169
4.5-2	Vegetation Types and Denuded Acreages, East Las Vegas System Alternative	4-171
4.5-3	Construction and Operation Disturbance by Land Ownership, East Las Vegas System Alternative	4-173
4.5-4	Construction and Operation Disturbance by Land Use, East Las Vegas System Alternative	4-174
4.6-1	Kern River Cumulative Impacts	4-177
4.8-1	Unavoidable Adverse Impacts, Kern River Proposal	4-217
4.9-1	Short-Term and Long-Term Impacts Resulting Kern River Proposal	4-220
4.10-1	Commitment of Resources Resulting from the Kern River Proposal	4-222

LIST OF FIGURES

Table	Title	Page
2.2-1	Location of the Kern River System	2-2
2.1-2	Compressor Station Layout for the Kern River Proposal	2-4
2.6-1	Proposed Routes and Alternatives Eliminated from Analysis	2-19
4.2-1	Visual Resources, Kern River Proposal, MP 40-60	4-78
4.2-2	Visual Resources, Kern River Proposal, MP 110-130	4-79
4.2-3	Visual Resources, Kern River Proposal, MP 130-146	4-81
4.2-4	Visual Resources, Kern River Proposal, MP 210-230	4-84
4.2-5	Visual Resources, Scipio Pass Photograph Location	4-85
4.2-6	Visual Simulation of Scipio Pass	4-86
4.2-7	Existing and Post Construction Visual Simulation of Sciopio Pass	4-87
4.2-8	Visual Resources, Kern River Proposal, MP 260-280	4-88
4.2-9	Visual Resources, Kern River Proposal, MP 370-380	4-89
4.2-10	Visual Resources, Kern River Proposal, MP 480-500	4-90
4.2-11	Visual Resources, Kern River Proposal, MP 540-555	4-91
4.2-12	Visual Resources, Kern River Proposal, MP 630-641	4-92
4.4-1	Visual Resources, Wasatch Ridge Photograph Location	4-114
4.4-2	Existing and Post Construction Visual Simulation of Wasatch Ridge	4-115
4.4-3	Visual Resources, Wasatch Variation, MP 36.4-44.4	4-116
4.4-4	Visual Resources, West Strawberry Variation, MP 5-10	4-131
4.4.5	Visual Resources, West Strawberry Variation, MP 9.6-24.7	4-133
4.4-6	Visual Resources, West Strawberry Variation, MP 29.1-43.2	4-135

1.0 INTRODUCTION

Refer to Introduction in Volume I.

2.0 DESCRIPTION OF PROPOSED PROJECTS

2.1 INTRODUCTION

This chapter describes the Kern River and Northwest proposals for transportation of natural gas from various points in the United States and Canada to the heavy crude oil fields of the southern San Joaquin Valley in the vicinity of Bakersfield, California. The Mojave, El Dorado, El Paso, and Transwestern summaries have been provided in Section 2.1 of Volume I.

In addition to Kern River's proposed route, a number of routing alternatives have been identified. These alternatives are presented following Kern River's proposed route. The No Action/ Project Alternative is also examined; several scenarios are addressed from no increase in natural gas use by the EOR/ cogeneration industry to industry conversion to natural gas supplied by intrastate systems. These scenarios follow the discussion of routing alternatives.

Due to the complexity of the proposals and the number of proposals under consideration, a general discussion of pipeline design, construction, operation, and maintenance has been provided in Section 2.1.1 of Volume I. Specific (or unique) practices proposed to be employed are described in the sections related to the individual applicants.

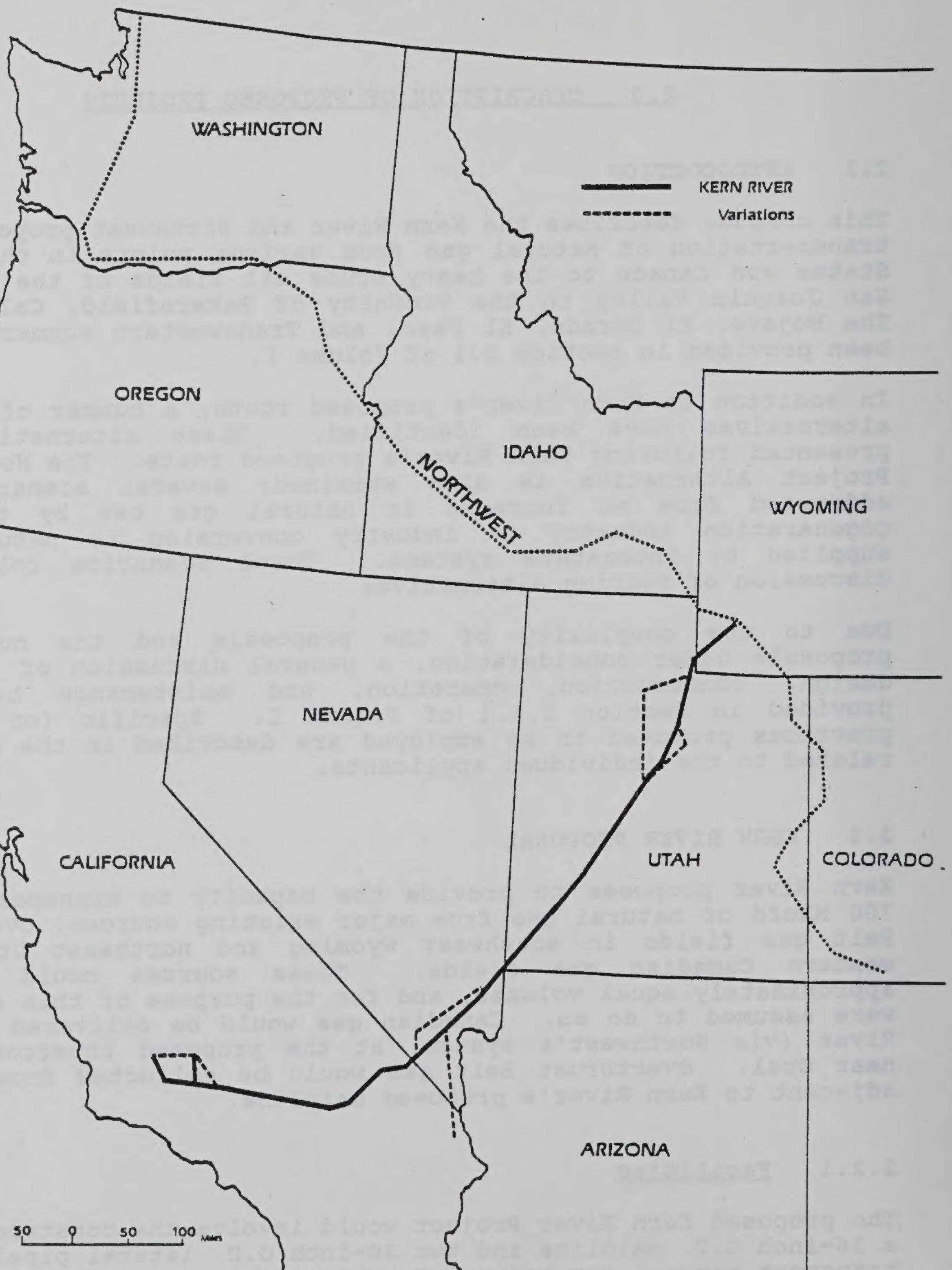
2.2 KERN RIVER PROPOSAL

Kern River proposes to provide the capacity to transport up to 700 MMcfd of natural gas from major existing sources: Overthrust Belt gas fields in southwest Wyoming and northeast Utah, and western Canadian gas fields. These sources could provide approximately equal volumes, and for the purpose of this analysis were assumed to do so. Canadian gas would be delivered to Kern River (via Northwest's system) at the proposed interconnection near Opal. Overthrust Belt gas would be collected from fields adjacent to Kern River's proposed mainline.

2.2.1 Facilities

The proposed Kern River Project would involve the construction of a 36-inch O.D. mainline and two 30-inch O.D. lateral pipelines to transport natural gas between Northwest's interstate transmission system near Opal, Wyoming, and the Bakersfield, California, area (Figure 2.2-1). The proposed system would extend a distance of approximately 837 miles through 15 counties in four states, distributed as indicated in Table 2.2-1 and Map 5 in Volume IV.

Figure 2.2-1


WASHINGTON
KERN RIVER
Variations
OREGON
IDAHO
NORTHWEST
WYOMING
NEVADA
CALIFORNIA
UTAH
COLORADO
ARIZONA
50 0 50 100 Miles

KERN RIVER SYSTEM

Three compressor stations providing a total of 35,500 hp would be constructed as a part of the project (see Figure 2.2-2 for a compressor station layout.) The project would directly affect a total of 7,600 acres of land during construction and 5,100 during operation. The route would follow existing utility and transportation corridors for approximately 54 percent (450 miles) of its length. Map 5 in Volume IV presents the location of the route.

Table 2.2-1

GEOGRAPHICAL DISTRIBUTION OF FACILITIES, KERN RIVER PROPOSAL

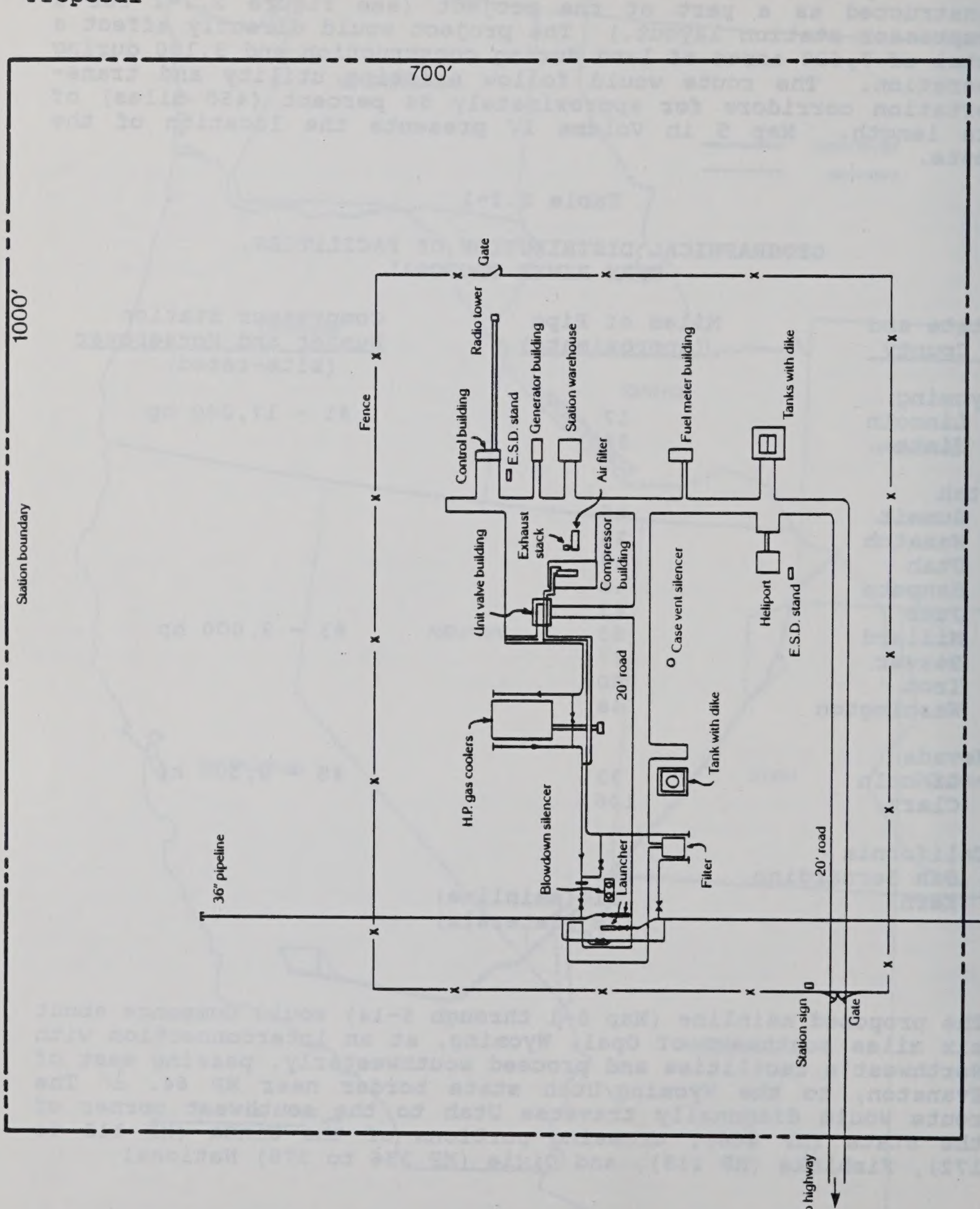
State and County	Miles of Pipe (approximate)	Compressor Station Number and Horsepower (site-rated)
Wyoming		
Lincoln	17	#1 - 17,000 hp
Uinta	38	
Utah		
Summit	45	
Wasatch	26	
Utah	37	
Sanpete	4	
Juab	43	
Millard	63	#3 - 9,000 hp
Beaver	37	
Iron	50	
Washington	48	
Nevada		
Lincoln	23	#5 - 9,500 hp
Clark	106	
California		
San Bernardino	144	
Kern	81 (mainline) 75 (laterals)	

The proposed mainline (Map 5-1 through 5-14) would commence about six miles southwest of Opal, Wyoming, at an interconnection with Northwest's facilities and proceed southwesterly, passing east of Evanston, to the Wyoming/Utah state border near MP 64.[1] The route would diagonally traverse Utah to the southwest corner of the state (MP 406), crossing portions of the Uinta (MP 112 to 172), Fishlake (MP 218), and Dixie (MP 356 to 378) National

---

[1] All mileposts are approximate.

Figure 2.1-2 Compressor Station Layout for the Kern River Proposal


700'
1000'
Station boundary
Fence
Gate
Radio tower
Control building
E.S.D. stand
Generator building
Station warehouse
Air filter
Fuel meter building
Tanks with dike
Unit valve building
Exhaust stack
Compressor building
Case vent silencer
Heliport
E.S.D. stand
20' road
Tank with dike
H.P. gas coolers
Blowdown silencer
Launcher
Filter
20' road
36" pipeline
36" pipeline
Station sign
Gate
To highway

Forests [2]. The route would proceed across the southern tip of Nevada, passing approximately five miles east of Las Vegas (MP 488), and crossing the Las Vegas Wash (MP 494), and the off-road recreational vehicle use area in the Ivanpah Valley (MP 511 to 548). At the Nevada-California border (MP 535), the route would enter the California Desert Conservation Area by way of the BLM Utility Corridor D. Corridor D would be followed to a point in the northern Mojave Valley where the route would turn west, entering Utility Corridor Q, and pass to the north of the Calico Mountains. Continuing westward, the mainline would pass seven miles north of Barstow and cross immediately north of Edwards Air Force Base (MP 670-696). The pipeline would then cross the Los Angeles Aqueduct (MP 711), the Pacific Crest National Scenic Trail (MP 717), and the Arvin Edison Canal (MP 755) before terminating at the bifurcation point (MP 756) about 19 miles south of Bakersfield.

The Taft Lateral (Map 5-14 and 5-15) would extend about 48 miles west of the bifurcation point, crossing the Elk Hills Naval Petroleum Reserve and the California Aqueduct (MP 25T) before passing east of and terminating on the north side of the town of McKittrick. From the bifurcation point, the Kern River Lateral (Map 5-16) would extend north a distance of 27 miles to the Kern River Oil Field, approximately two miles north of Bakersfield on the east side of Oildale. [3] The lateral would cross the Arvin Edison Canal (MP 16KR), the East Side Canal (MP 17KR), and the Kern River (MP 24KR).

The three new compressor stations would be located at MP 0 (six miles southwest of Opal, Wyoming, and adjacent to Northwest's existing Muddy Creek Station), MP 260 (24 miles southwest of Fillmore, Utah), and MP 516 (22 miles southwest of Las Vegas, Nevada).

All pipeline utilized would be designed for a maximum allowable operating pressure of 1,200 pounds per square inch (gauge) pressure. All pipe surfaces, both external and internal, would be coated with a thin film of epoxy at the mill to protect it during shipping and handling and to improve flow efficiency. Corrosion control would be achieved by the use of sacrificial anodes at various locations to be preferentially corroded or by the use of direct current rectifiers. The appropriate control system would be completely installed within one year following construction.

---

[2] National Forest mileage is not continuous and represents an "envelope" within which other lands are crossed.

[3] Both Mojave and Kern River use the term "Kern Lateral". For clarity, the term "Kern River Lateral" shall be used when referring to the appropriate portion of the Kern River Project. Also, MP numbers along the Kern River and Taft Laterals are followed by "KR" and "T" respectively.

Markers would be installed along the ROW in the size, color, type, location, and number required by DOT regulations.

Existing roads or the ROW itself would be used for surface travel whenever possible. New access road construction outside of the one-mile wide corridor established for environmental review would require additional data collection outside of the scope of the EIR/EIS. Existing access roads would be utilized for construction wherever possible. Improvements of some existing roads may be necessary for access to other surface facility sites during operation. Use or construction of any roads across public lands would require a ROW easement from the appropriate governmental body. At present, the locations of new access roads or access roads which would require improvements have not been identified by the applicant.

The project would require a minimum construction ROW width of 75 feet, although a 100 foot ROW width would be more common. Additional land would be required at watercourse, railroad, road, and highway crossings. Additional space would also be required for metering stations, communications facilities, maintenance bases, and pipe storage and staging areas as necessary. These requirements would range from about 0.5 acre for a new communications site up to four acres for a major river crossing. The extent and number of maintenance and staging areas have not yet been determined. A permanent ROW of about 50 feet would be maintained following construction. Except at above-ground facilities, any access roads, and where the line crosses formerly wooded areas, the ROW could be returned to its former condition following construction use as long as structures were not built on it. The proposed compressor station sites would require about 20 to 50 acres each. The locations of communications sites are presented in Table 2.2-2.

Table 2.2-2

PRELIMINARY MICROWAVE SITE LOCATIONS

Description	Legal Description	Site Status
Muddy Creek Compressor Station, WY	NW1/4 S25 20N 115W	Existing Compressor Station Yard
Quealy Peak, WY	SE1/4 S31 22N 115W	Existing
Medicine Butte, WY	SW1/4 S24 16N 120W	Existing
Evanston, WY (Maintenance Office)	- - - -	New Office Grounds
Elk Horn Peak, UT	NW1/4 S22 1N 6E	New* Private Land
Wide Hollow Radio Tower (USFS), UT	SW1/4 S12 1S 12W	Existing
Lake Mountain, UT	SE1/4 S21 6S 1W	Existing
Salt Lake City, UT (Maintenance Office)	- - - -	Existing Office
Mt. Baldy, UT	SW1/2 S22 12S 3E	Existing

Table 2.2-2 (continued)

PRELIMINARY MICROWAVE SITE LOCATIONS

Description	Legal Description	Site Status
West Juab Valley, UT	SW1/4 S35 13S 1W	New Private Land 1/
Scipio Pass, UT	SE1/4 S34 18S 3W	Existing
Compressor Station #3, UT	NE1/4 S10 24S 7W	New Compressor Station Yard
South Pinnacle Pass Radio Tower, UT	NW1/4 S30 26S 8W	Existing
Frisco Peak, UT	SW1/4 S27 26S 13W	Existing
Cedar City, UT (District Office)	- - - -	New Office Grounds
Antelope Mountains, UT	NW1/4 S6 36S 14W	New* BLM
West Mountain Peak, UT (Beaver Dam Mountains)	SE1/4 S5 42S 18W	Existing
East Mormon Mountains, NV	NW1/4 S16 12S 69E	Existing
Arrow Canyon Range, NV	NE1/4 S15 17S 63E	Existing
Compressor Station #5, NV	NE1/4 S15 24S 60E	New Compressor Station Yard
Mohawk Peak, CA	SE1/4 S10 16N 13E	Existing
Cave Mountain, CA	NE1/4 S3 11N 6E	New* Private
Calico Peak, CA	NE1/4 S2 10N 1E	Existing
Kramer Hill, CA	SE1/4 S4 9N 6W	Existing
Shrub Peak, CA	SE1/4 S34 12N 14W	Existing
Bear Mountain, CA	NW1/4 S27 31S 31E	New* Private
Bakersfield, CA (District Office)	- - - -	New Office Grounds

1/ Outside of the mile-wide analysis corridor

2.2.2 Construction, Operation, and Maintenance

The reader is referred to Section 2.1.1 of Volume I for a general description of pipeline design, construction, operation, and maintenance procedures. Practices described in the following sections are unique to Kern River.

2.2.2.1 Pipeline Construction Methods

Approximately 200,000 to 268,000 gallons of water per mile would be required to hydrostatically test the proposed 30- and 36-inch pipe, respectively. Although precise locations and the volume of water to be withdrawn from each have not yet been identified, potential sources of hydrostatic test water are presented in Table 2.2-3. Intake and discharge rates may range widely because of varying conditions at the time; however, intake rates would probably be in the 2,500 to 3,000-gallons-per-minute range and discharge rates in the range of 1,500 to 2,000 gallons per minute.

Table 2.2-3

POTENTIAL WATER SOURCES FOR HYDROSTATIC TESTING

Source	Approximate Milepost	State
Albert Creek	15	Wyoming
Bear River	48	Wyoming
Chalk Creek	70	Utah
Weber River	80	Utah
Provo River	100	Utah
Diamond Fork	140	Utah
Spanish Fork River	145	Utah
Salt Creek	175	Utah
Chicken Creek Reservoir	200	Utah
Sevier River	210	Utah
Chalk Creek	240	Utah
Newcastle Reservoir	355	Utah
Santa Clara River	375	Utah
Lake Mead	450 and 490	Nevada
Los Angeles Aqueduct	715	California
California Aqueduct	23 (Taft Lateral)	California
East Side Canal	20 (Kern Lateral)	California

2.2.2.2 Construction Workforce and Schedule

Kern River proposes to use a total of nine construction spreads simultaneously for construction of the mainline, laterals, and compressor stations. Each spread would employ approximately 400 persons. Spread 1 would cover MP 0 to 75; Spread 2 from MP 75 to 132; Spread 3 from MP 132 to 190; Spread 4 from MP 190 to 310; Spread 5 from MP 310 to 405; Spread 6 from MP 405 to 540; Spread 7 from Mp 540 to 650; Spread 8 from MP 650 to 762; and Spread 9 from MP 762 to 837. It is likely that construction workers would seek temporary housing and related services in the cities and towns present along the route. It is anticipated that 40 percent of the workforce would be locally hired.

The entire system would be constructed within a 10 to 12 month period, with construction along any one location along the route to be completed within six to eight weeks from initial land disturbance to the end of restoration. However, the trench would only be open for four to five days at any given locality. Approximately two for four miles of ditch would remain open at any one place dependent on weather conditions, terrain and soil conditions. Approximately 100-110 vehicles would be operated simultaneously at any given spread location.

2.2.3 Environmental and Safety Controls

Environmental and safety controls pertinent to all applications under consideration are discussed in Section 2.1.1.4 of Volume I. Kern River has developed sediment and erosion control guidelines which would be followed during construction and restoration of the ROW. The USDA Forest Service has developed Forest Service Erosion Control, Revegetation, and Restoration Guidelines and Forest Service General Mitigation Measures. These guidelines and measures will be followed on National Forest System lands. The guidelines are included as Appendix F; the mitigation measures are presented in Section 4.10.6 of Volume I.

2.2.4 Future Plans and Abandonment

Although Kern River has developed no plans for future expansion or modification of the project, it indicates that the system throughput capacity could be increased to 1,000 MMcfd by adding 55,000 hp installed at three additional compressor stations along its mainline. If necessary, these additional stations would be located between proposed Compressor Station Nos. 1, 3, 5, and the system bifurcation point in Kern County, California. Any subsequently required facilities would be compatible with those of the current proposal.

The estimated life of the proposed pipeline is 30 to 40 years. Upon cessation of operation, an abandonment plan will be assessed. The compressor stations and other ancillary surface facilities would be dismantled. Equipment would be salvaged or reused to the extent possible. The compressor station foundations would be broken up, refuse would be hauled to approved disposal sites, and the sites would be revegetated and restored in accordance with applicable regulations in effect at that time.

2.3 NORTHWEST PROPOSAL

Northwest proposed to transport up to 350 MMcfd of natural gas on behalf of the Bakersfield EOR/cogen industry from its existing point of interconnection with Westcoast Transmission Company, Limited, on the Canadian border near Sumas, Washington, and the proposed interconnection with Kern River near Opal. Northwest would use its existing mainline facilities to deliver thermally equivalent volumes of gas, less fuel requirements, to the proposed interconnection. Northwest also proposes to construct and operate a mainline tap and metering station necessary to transfer the gas to Kern River.

2.3.1 Facilities

Northwest's proposed transportation service would require no new facilities. The proposed interconnection with Kern River would be constructed within the station yard of Northwest's existing Muddy Creek Compressor Station in Lincoln County, Wyoming, immediately adjacent to Kern River's MP 0. Northwest would require two 22-inch mainline taps, one meter station with three 16-inch meter runs, and appurtenant piping. The proposed meter station would measure gas deliveries to Kern River's Compressor Station No.1 and would include a meter building, a communications building, and associated equipment.

2.3.2 Construction, Operation, and Maintenance

Construction of Northwest's proposed tap and metering facilities would be expected to take no more than two months and would conform to all applicable design codes and standards set by the U.S. Department of Transportation. The facility would be operated and maintained as part of Northwest's existing transmission system. A general description of pipeline construction, operation, and maintenance procedures is presented in Section 2.1.1.3 of Volume I.

2.3.3 Environmental and Safety Controls

General environmental and safety controls pertinent to Northwest's proposed facilities are presented in Section 2.1.1.4 of Volume I. Northwest's tap and metering facilities would be isolated from its mainline system by two 22-inch fall opening ball values with remote control operators. Communications equipment already in place for remote control of the Muddy Creek Compressor Station would be supplemented to allow unattended operation of the proposed tap.

2.3.4 Future Plans and Abandonment

Although Northwest has developed no plans at this time to transport additional gas for delivery to Kern River, its proposed tap and metering facilities would be sized for an ultimate capacity of 576 MMcfd at 700 psig. General facility abandonment procedures are presented in Section 2.2.4.

2.4 KERN RIVER ROUTE VARIATIONS

2.4.1 Wasatch Variation

The Wasatch Variation was identified by Kern River as an alternative to crossing approximately 100 miles of rugged, mountainous terrain which would be traversed by the proposed route (Map 5-17 through 5-20). This variation also avoids severe land stability problems encountered along the proposed route across the Uinta National Forest. The variation is approximately 154 miles in length, versus 131 miles along the portion of the proposed route it would replace. The variation diverges from the proposed route at approximately MP 73, east of Upton, Utah, where it would turn west and parallel the valley between Upton and Coalville, in the lower foothills. West of Coalville the alignment would basically parallel Mountain Fuel Resources Incorporated (MFR) recently constructed 20-inch pipeline to the ridge north of Holbrook Canyon in Section 24, T2N, R1E. The variation would then diverge from MFR's alignment and the Wasatch-Cache National Forest designated utility corridor, crossing over the summit of the Wasatch Range into the community of North Salt Lake. The variation would proceed south parallel to existing high voltage electrical transmission lines on the west side of the Salt Lake Valley, passing west of Utah Lake and eventually rejoining the primary route near MP 204, in the vicinity of the Sevier River.

If the proposed route were modified to incorporate the Wasatch Variation, three compressor stations would be required. Neither the location nor the horsepower of proposed Compressor Station No. 1 would be altered. However, use of the Wasatch Variation would require relocation of Compressor Station No. 3 approximately 20 miles north of its proposed location, to the Pavant Valley (about five miles west of Meadow, Utah). New Station No. 3 would require a 500 hp increase to 9,500 hp. Compressor Station No. 5 would be relocated about 10 miles northeast of its proposed location to a position about 14 miles southwest of Henderson, Nevada. An 800-hp increase in compression would be required at this station, totaling 10,300 hp.

2.4.2 West Strawberry Variation

The West Strawberry Variation was identified by Kern River as an alternative to avoid some of the rugged, unstable terrain crossed by the primary route on the Uinta National Forest. The variation would add about seven miles to the 57-mile-long segment of the proposed route it replaces.

This variation would leave the proposed Kern River alignment in the Strawberry River Valley, near MP 119, pass along the foothills bordering the west side of Strawberry Reservoir, and follow Indian Creek to the summit of Strawberry Ridge (see Map 5-21). From there, the alignment would basically follow Partridge Ridge and Tie Fork Canyon Road across a portion of the Uinta National Forest (MP 7-27) down to Spanish Fork Canyon and U.S. Highway 6. The route would continue to the southwest across a portion of the Manti-LaSal National Forest (MP 34-47) generally by way of Mill Fork, Poison, and Jones Ridges to the Indianola area, and then on to the east side of the Salt Creek Canyon east of Nephi where the variation would rejoin the proposed route near MP 176.

Compressor requirements would not be affected if Kern River's proposed route incorporated the West Strawberry Variation.

2.4.3 Salt Creek Canyon Variation

The Salt Creek Canyon Variation was developed as a canyon/valley construction alternative to Kern River's proposed crossing of the northern tip of the San Pitch Mountains east of Nephi, Utah. The variation is about 14 miles long, versus 12 miles along the portion of the proposed route which it would replace.

The variation would leave the proposed Kern River alignment where the alignment breaks south to depart from Utah State Highway 132 at MP 180. The route would parallel State Highway 132 westward through Salt Creek Canyon to Nephi (see Map 5-22). At Nephi the route would cross U.S. Highway 91 and would then head south paralleling the Union Pacific Railroad to MP 192 where it would rejoin the Kern River's proposed route west of Levan in Juab County, Utah.

Compression requirements would not be affected if Kern River's proposed route incorporated the Salt Creek Canyon Variation.

2.4.4 North Las Vegas Variation with the Goodsprings Spur

The North Las Vegas Variation was developed by Kern River as an alternative to crossing the Rainbow Gardens (MP 490), the Las Vegas Wash, and the southern Las Vegas Valley in general. This variation, utilizing the Goodsprings Spur, would require 109 miles of pipeline, compared to 96 miles for the corresponding segment of the proposed route.

This variation would begin about 8 miles northeast of Glendale, Nevada, where Kern River's proposed route leaves the Intermountain Power Project (IPP) powerline ROW at MP 438. This variation would continue paralleling the IPP powerline for its first 27 miles, generally following a BLM utility corridor across the expanded Moapa River Indian Reservation to a point in Section 28, T16S, R64E (see Map 5-23 through 5-25). Here the variation would continue in a southwesterly direction along a powerline ROW to a position north-northeast of Arrolime Siding in Section 31, T17S, R64E. The variation would then leave this ROW and proceed cross-country on a more westerly heading, crossing U.S. Route 93 before joining another powerline ROW in Section 19, T18S, R63E. This ROW would be followed south-southwest into the Las Vegas Valley, then west-southwest along a path between Nellis Air Force Base (AFB) on the north and the Union Pacific Railroad on the south, and finally due west across the north rise of the valley. [4] The variation would then turn to the southwest, crossing U.S. Route 95 in Section 28, T19S, R60E, before continuing to the west along

---

[4] The variation would follow powerline ROWs which briefly cross onto Nellis AFB in two locations, totalling about three miles in length.

Ann Road. The variation would turn to the south, north of Lone Mountain, proceeding along this heading for approximately nine miles before bending to the southwest in Section 7, T21S, R60E. The variation would follow this heading for approximately thirteen miles, crossing the Bird Spring Range and entering the upper end of the Goodsprings Valley.

From here (Section 25, T23S, R58E), the Goodsprings Spur would proceed down the Goodsprings Valley to an intersection with Kern River's proposed route near MP 534 in Section 6, T27S, R59E, Clark County, Nevada.

If Kern River's proposed route were modified to incorporate this variation, Compressor Station No. 5 would require relocation to the vicinity of Goodsprings, Nevada, in Section 13, T23S, R58E, or about 10 miles due west of its proposed location. No significant change in compression would be necessitated by the relocation.

2.4.5 Henderson Variation

The Henderson Variation was developed by Kern River to minimize impacts to large areas of undeveloped, subdivided tracts within the corporate limits of the City of Henderson, Nevada, which might be realized with the northeast/southwest alignment of the proposed route in this area. The variation parallels existing roads throughout to achieve this end. Total length of the Henderson Variation is about 15.3 miles, approximately 1.5 miles longer than the portion of the proposed route which it would replace.

This variation would begin at MP 496.1 in Section 34, T21S, R62E, 0.5 mile south of East Las Vegas. It would run west along Russell Road (south side), turn south along Stephanie Street (east side) to State Highway 41 (Lake Mead Drive), then westerly along State Highway 146 (north side) to U.S. Highway 466 and 91 (see Map 5-26). From here, it would proceed south along 466 and 91 (east side) and would end where it intersects the proposed route near MP 509.9, 2 miles southeast of Sloan, Nevada, in Section 20, T23S, R61E. Approximately 7.46 miles of this variation would lie within the Henderson corporate limits as compared with approximately 9.37 miles of the proposed route. Compression requirements would not be affected.

2.4.6 North Bakersfield Variation

The North Bakersfield Variation was developed by Kern River in an attempt to substantially reduce pipeline mileage in the San Joaquin Valley. While the original concept was to terminate the westernmost segment at the same point as the proposed Taft Lateral, subsequent studies indicated that the western segment would require a 17-mile extension along the proposed Taft Lateral route to serve EOR operations at the Midway-Sunset Oil Field. The total variation length became almost 111 miles, compared with about 108 miles for the corresponding portions of the proposed route.

The North Bakersfield Variation would consist of four segments, including a portion of the proposed route (the west end of the Taft Lateral). This variation is illustrated on Map 5-27 and 5-28.

The Tehachapi segment would leave Kern River's proposed route near MP 722, in Section 31, T12N, R14W, approximately 34.3 miles east of the bifurcation point. This segment would proceed in a northerly direction across the Tehachapi Valley and would then turn northwesterly, staying northeast of State Highway 58 and Tehachapi Creek. The route would cross Tehachapi Creek near Caliente heading in a northwesterly direction. It would cross Caliente Creek and would parallel the creek until it intersects with the beginning of the Kern River segment. The Tehachapi segment would be about 30 miles long.

The Kern River segment would begin in Section 4, T30S, R30E, and would continue in a northwesterly direction, north of all cultivation. It would cross State Highway 178 in Section 20, T29S, R29E, and then would proceed in a northwesterly direction to the intersection of Southern California Edison transmission lines. The route would follow the powerlines northwest crossing the Kern River in Section 35, T28S, R28E, to a point in Section 21, T28S, R28E. The North Bakersfield Variation would bifurcate at this point with the Taft segment heading west and the Kern River Lateral segment proceeding southwesterly to the Kern River Oil Field. The Kern River segment would be 20 miles long.

The Taft segment would begin at the bifurcation point in Section 21 and would continue in a northwesterly direction following powerlines to Section 16, T28S, R28E. The route would then turn west staying north of the Kern River Oil Field. In Section 14, T28S, R27E the route would enter the Kern Front Oil Field heading westerly to a point in Section 15 where it would turn to the southwest before entering farmlands in Section 28. The route would bend to the west in Section 24, T29S, R25E, following the Southern Pacific Railroad and State Highway 58 on the south side. In Section 22, T29S, R24E, the route would turn west-southwest to a point in Section 27, T29S, R23E, where powerlines would be joined (one mile south of Buttonwillow), heading to a point in Section 9, T30S, R22E. The route would then proceed cross-country on a southwesterly heading to the terminus of the Taft segment at Kern River's proposed route MP 47.5T. The length of the Taft segment would be almost 43 miles long.

From MP 47.5T, the proposed route segment would proceed southeasterly along the Taft Lateral, a distance of 17.1 miles to MP 30T which would become the terminus of the North Bakersfield Variation.

Compression requirements would not be affected if Kern River's proposed route incorporated the North Bakersfield Variation.

2.5 SYSTEM ALTERNATIVES TO KERN RIVER

2.5.1 Mojave Proposal and Alternatives to Mojave

(see Volume I, Sections 2.2 and 2.3)

2.5.2 El Dorado Proposal

(see Volume I, Section 2.5)

2.5.3 East Las Vegas/Integrated Intrastate System Alternative

This alternative referred to as the East Las Vegas Alternative was suggested by the FERC staff as a possible means of reducing pipeline mileage (and therefore environmental impact) associated with Kern River's proposed route between Las Vegas, Nevada, and Bakersfield, California. The alternative would follow a route originally identified as part of the Rocky Mountain Pipeline Project (RMPP) between a point on Kern River's proposed route in T21S, R63E, north of Henderson, Clark County, Nevada (MP 491) and the RMPP termination point in T7N, R19E, south of Camino, San Bernardino County, California (see Map 5-29 and 5-30). A FEIS was issued for the RMPP project by FERC and BLM in February 1983. The route proposed in the RMPP was similar to that now proposed by Kern River, except south and west of Las Vegas. The final 14 miles of this alternative would intersect major intrastate transmission facilities owned by SoCal and PG&E. The gas would be delivered to both of these systems which would operate in an integrated fashion using spare capacity and a new 17,000-hp compressor station on PG&E's system near Danby to transport the gas 240 miles westward to the Bakersfield area. Use of the East Las Vegas Alternative would substitute 104 miles of pipeline construction between Las Vegas and the Camino area for the 265 miles proposed by Kern River between Las Vegas and Bakersfield. This report also assumes that the California intrastate systems would need to construct delivery laterals in the Bakersfield area, similar to the 75 miles of laterals proposed by Kern River.

This alternative would head south and southeast crossing State Highway 41 northeast of Henderson. It would then cross U.S. Highway 93 and the Union Pacific Railroad at the juncture with U.S. Highway 95. The route would then parallel Highway 95 on the east side skirting the Lake Mead NRA in Clark County, Nevada, within the El Dorado Valley. Once past Searchlight, Nevada, the alternative would cross Highway 95 and head due south. At the Nevada/California border the route would enter BLM Utility Corridor E which it would follow south (around the west side of

Homer Mountain) to cross the Atchison, Topeka, and Santa Fe Railroad (west of Homer) and Interstate Route 40 (just west of Camino) before terminating at PG&E's dual transmission line ROW.

2.5.4 East Las Vegas/Intergrated Intrastate System Alternative with the Wasatch Variation

This alternative would merge the Wasatch Variation and the East Las Vegas Alternative, reducing the length of Kern River's route from 756 miles to 617 miles by replacing it between MP 73 and MP 204 and eliminating it entirely downstream of MP 491.

The East Las Vegas Alternative and the Wasatch Variation have been described in Sections 2.4.3 and 2.3.1, respectively.

2.5.5 Northwest/PGT/Integrated Intrastate System Alternative

This alternative was developed by the FERC staff to explore the feasibility of providing the EOR/cogeneration industry with direct access, by way of existing transmission systems, to major sources of natural gas in western Canada and the southwest/south-central U.S. without construction of a major new system as proposed by Kern River. The alternative would use two major gas transmission corridors linking production regions with the Bakersfield area. One corridor extends south from Canada through Idaho, and/or Washington, Oregon, and California along interstate and intrastate pipelines owned by Northwest, Pacific Gas Transmission Company (PGT), and PG&E. The other corridor extends between west Texas and southern California. As discussed in detail in Volume I, pipeline systems owned by Transwestern and El Paso span New Mexico and Arizona to interconnect with PG&E and SoCal at the California border.

Specifically, Canadian Gas would reach PG&E on the Oregon/California border by one of two routes. Gas would be delivered to PGT at the Canadian border near Eastport, Idaho, and transported southwest across the Idaho panhandle and southeastern Washington, through central Oregon, to a delivery point with PG&E on the Oregon/California border near Malin, Oregon. Alternately, Canadian Gas could be shipped on Northwest's system between the border near Sumas, Washington, and an existing interconnection with PGT's system near Stanfield, Oregon, and then delivered to PG&E via PGT. From here, PG&E would transport the gas southward for ultimate delivery to the Bakersfield area. [5/] Gas from the southwest and south central U.S. would be transported through the Transwestern and/or El Paso systems for delivery to PG&E and

---

[5/] This scenario would also involve interstate transmission facilities owned by Standard Pacific Gas Line, Incorporated (StanPac), which link PG&E's northern and southern systems in central California.

SoCal, operating in an integrated fashion, west of Topock, Arizona, and near Needles, California. For analysis, this alternative assumes that Kern River's proposed throughput would be divided equally with half coming from each production area, i.e., 350 MMcfd each from Canada and west Texas. This alternative would require no new facilities to be constructed in either corridor.

2.6 NO ACTION PROJECT ALTERNATIVE

The No Action Project Alternative involves two scenarios ranging from no action at both the intrastate and interstate level, i.e., a status quo case, to one in which the EOR/cogeneration industry was able to convert to natural gas as its primary fuel as supplied by California's intrastate systems.

2.6.1 Status Quo Scenario

This scenario would entail the denial of all proposals for construction or operation of natural gas pipelines discussed in Volumes I and II, and limiting the California intrastate pipelines from serving any more of the EOR/cogen industry than it presently serves. EOR operations in the Southern San Joaquin Valley would then continue using crude oil as the primary fuel for the generation of steam.

2.6.2 Intrastate Alternative Systems

(see Section 2.4.3 of Volume I and Section 2.4 of this volume)

2.7 ROUTE VARIATIONS AND SYSTEM ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

The following alternatives were eliminated from detailed analyses because of economic, feasibility, and/or environmental constraints. The process of elimination was initiated by using the following basic issues and assumptions:

1) The alternative must provide a firm supply of gas to the Bakersfield area in California. In the case of the Kern River Project, this volume of gas is assumed to be 700 MMcfd;

2) The alternative must be economically viable in terms of initial capital investment, operating costs, and reliability;

3) The alternative must be technically feasible and practical;

4) In the case of alternatives to the Kern River Project, no more than 350 MMcfd is assumed to come from Canadian sources; and,

5) The alternative must offer clear environmental advantages to the proposed project.

Using these criteria six levels of screening were used to evaluate alternatives and ultimately resulted in eliminating a number of routes from detailed analyses. These criteria are discussed below and the alternative routes eliminated are examined within each criteria category. Figure 2.6-1 and Table 2.6-1 indicates the locations of the systems, alternatives, and variations discussed below.

The initial alternatives evaluation study, a summary of which is presented below, was completed in the spring of 1986 as prelude to field collection of resource data for the remaining route alternatives. Since its completion, Kern River has refined various aspects of its proposal, most notable of which are its compression requirements and estimated overall project cost as reflected in testimony filed with the FERC on October 1, 1986. Because facility requirements and base project cost are integral to the study and several of the screening criteria, the FERC staff considered the merits of completely reworking the study to reflect Kern River's updated figures. Based on the following reasons, the staff decided not to update the study:

a) first, it is anticipated that facility and cost refinements will be an ongoing activity;

b) given the magnitude of the updated figures, as well as the fact that compression requirements and total cost were both moved downward, it is felt that the overall conclusions reached by the study would not radically change.

If compression requirements and costs associated with the alternatives were reduced by a factor commensurate with Kern River's revised figures, the conclusions would be identical. If these parameters were not reduced to the extent that Kern River's were (or not reduced at all), the proposed route would appear even more favorable. Finally, we found no basis to support the position that compression and costs associated with eliminated alternatives have changed by more than Kern River's figures on a percentage basis. The staff therefore concluded that revising the study had no practical value. For clarity, Kern River's initial (upon which the study was based) and current compression requirements and project costs are presented below.

	Pre 10/1/86	Post 10/1/86
Compressor Station No. 1	18,200	17,000
Compressor Station No. 3	9,100	9,000
Compressor Station No. 5	9,900	9,500
Total horsepower	37,200	35,500
Total Project Cost (in millions)	\$824.7 (1985\$)	\$713.7 (1986\$)

Figure 2.6-1

PROPOSED ROUTE AND ALTERNATIVES ELIMINATED FROM ANALYSIS

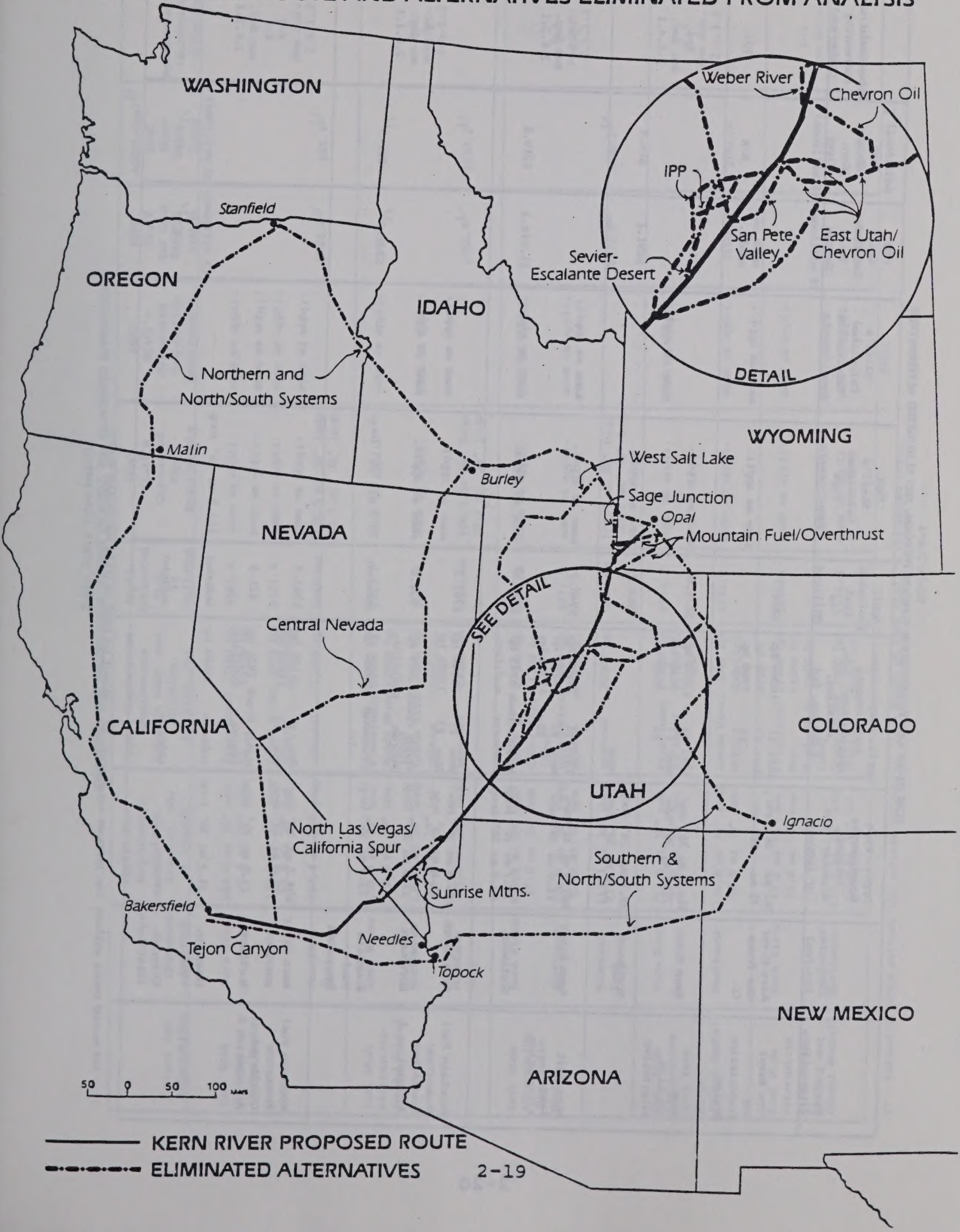

WASHINGTON
OREGON
IDAHO
WYOMING
NEVADA
UTAH
COLORADO
CALIFORNIA
ARIZONA
NEW MEXICO
Weber River
Chevron Oil
IPP
San Pete Valley
East Utah/ Chevron Oil
Sevier-Escalante Desert
DETAIL
Stanfield
Northern and North/South Systems
Malin
Burley
West Salt Lake
Sage Junction
Opal
Mountain Fuel/Overthrust
SEE DETAIL
Central Nevada
North Las Vegas/ California Spur
Sunrise Mtns.
Southern & North/South Systems
Ignacio
Bakersfield
Tejon Canyon
Needles
Topock
50 0 50 100 MILES
KERN RIVER PROPOSED ROUTE
ELIMINATED ALTERNATIVES

Table 2.6-1
KERN RIVER GAS TRANSMISSION COMPANY PROPOSAL AND ELIMINATED ALTERNATIVES

Project and Alternatives	Companies Involved	Appli. Pipe Requirements (mileage, diameter, new or looped)	Appli. Compression Requirements (station name, new, existing, location, hp)	Appli. Estimated Cost in Millions	FERC Staff's Calculated Pipe Requirements	FERC Staff's Calculated Compression Requirements	FERC Staff Est Cost Total System ($ millions)	Additional [2/] Cost Above Kern River ($ millions)	Recommendations (screening criterion)
Kern River Gas Transmission System	Kern River Gas Trans Co.	762 mi 36" new 75 mi 30" new	(All #1 18200 hp New) #3 9100 hp #5 9900 hp	$824.7	same as appli.	same as appli.	same as appli.	N/A	N/A
Sage Junction Alternative	Kern River	760.0 mi 36" new 75.0 mi 30" new	(All #1 17900 hp New) #3 9100 hp #5 9900 hp	$826.8	same as appli.	same as appli.			E-4 see Sec. 2.6.4.1
	Northwest	39.7 mi 24" loop 62.0 mi 30" lat.	none	$68.2	same as appli		$891.1	$66.4	
West Salt Lake Alternative	Kern River	887.0 mi 36" new 75.0 mi 30" new	(All #1 26900 hp New) #3 12200 hp #5 11700 hp	$940.9	same as appli.	same as appli.			E-2 see Sec. 2.6.2.1
	Northwest	78.2 mi 30" loop 62.0 mi 30" loop	Muddy Creek 5243 hp Kemmerer modifica.	$116.6	same as appli.	same as appli.	$1,044.3	$219.6	
Mountain Fuel Resources/ Overthrust Alternative A	Kern River	694.5 mi 36" new 75.0 mi 30" new	New #1 26100 hp New #3 11800 hp	$763.3	same as appli.	same as appli.			E-1 see Sec. 2.6.1.1
	Northwest	23.8 mi 26" loop	Muddy Creek 2921 hp Pegram modifica.	$21.8	same as appli.	same as appli.			
	Mountain Fuel Resources	73.9 mi 36" loop	Crossover 16 15000 hp	unknown	78.3 mi 36" loop		$846.0[1/]	$21.3[1/]	
Mountain Fuel Resources Overthrust Alternative B	Kern River	694.5 mi 36" new 75.0 mi 30" new	New #1 26100 hp New #3 11800 hp	$763.3	same as appli.	same as appli.			E-1 see Sec. 2.6.1.1
	Northwest	23.8 mi 26" loop	Muddy Creek 2921 hp Pegram modifica.	$21.8	same as appli.	same as appli.			
	Mountain Fuel	34.3 mi 36" loop	unknown 15600 hp	unknown	112.5 mi 36" loop				
	Colorado Interstate	unknown	unknown	unknown			$874.2[1/]	$49.5[1/]	

1/ - Estimated costs without the unknown category; 2/ - Based on FERC staff's estimated costs

Table 2.6-1 (continued)
KERN RIVER GAS TRANSMISSION COMPANY PROPOSAL AND ELIMINATED ALTERNATIVES

Project and Alternatives	Companies Involved	Appli. Pipe Requirements (mileage, diameter, new or looped)	Appli. Compression Requirements (station name, new, existing, location, hp)	Appli. Estimated Cost in Millions	FERC Staff's Calculated Pipe Requirements	FERC Staff's Calculated Compression Requirements	FERC Staff Est Cost Total System ($ millions)	Additional[2] Cost Above Kern River ($ millions)	Recommendations (screening criterion)
East Utah Alternative (Pines Route)	Kern River	604.0 mi 36" new 75.0 mi 30" new	Pines(new) 27400 hp #5 12400 hp	$663.6	same as appli.	same as appli.			E-1 see Sec. 2.6.1.2
	Northwest	130.0 mi 36" loop 62.0 mi 30" lat.	Green River 2000 hp others upgrades	$171.9	same as appli.	same as appli.			
	Mountain Fuel	157.4 mi 36" loop	unknown 36200 hp	unknown	106.5 mi 30" loop 49.1 mi 36" loop		$909.4[1]	$84.7[1]	
East Utah Alternative (Nephi Route)	Kern River	658.0 mi 36" new 75.0 mi 30" new	Pines(new) 24600 hp Muddy Mtns 12900 hp (new)	$713.1	same as appli.	same as appli.			E-1 see Sec. 2.6.1.2
	Northwest	130.0 mi 36" loop 62.0 mi 30" lat.	Green River 2000 hp others modifica.	$171.9	same as appli.	same as appli.			
	Mountain Fuel	89.6 mi 36" loop	unknown 24500 hp	unknown	106.4 mi 30" loop 49.1 mi 36" loop		$956.9[1]	$132.2[1]	
East Utah Alternative (Newcastle Route)	Kern River	630.0 mi 36" new 75.0 mi 30" new	(New) #1 27500 hp Cedar City 11700 hp (new)	$686.9	same as appli.	same as appli.			E-1 see Sec. 2.6.1.1
	Northwest	130.0 mi 36" loop 62.0 mi 30" new	Green River 2000 hp others modifica.	$171.9	same as appli.	same as appli.			
	Mountain Fuel	112.3 mi 36" loop	unknown 26500 hp	unknown	106.4 mi 30" loop 49.1 mi 36" loop		$932.8[1]	$108.1[1]	
East Utah Alternative with Kern River (Pines Route)	Kern River	757.0 mi 36" new 75.0 mi 30" new	Pines(new) 27700 hp #3 (new) 11700 hp #5 9900 hp	$834.2	same as appli.	same as appli.			E-3 see Sec. 2.6.3.1
	Northwest	130.0 mi 36" loop 62.0 mi 30" lat.	Green River 2000 hp others modifica.	$171.9	same as appli.	same as appli.	$1006.1	$181.4	
East Utah Alternative with Kern River (Nephi Route)	Kern River	747.6 mi 36" new 75.0 mi 30" new	Price(new) 27700 hp New 11900 hp Muddy Mtns 9900 hp (new)	$820.0	same as appli.	same as appli.			E-3 see Sec. 2.6.2.1
	Northwest	130.0 mi 36" loop 62.0 mi 30" lat.	Green River 2000 hp others modifica.	$171.9	same as appli.	same as appli.	$991.9	$167.2	

1/ - Estimated costs without the unknown category; 2/ - Based on FERC staff's estimated costs

Table 2.6-1 (continued)
KERN RIVER GAS TRANSMISSION COMPANY PROPOSAL AND ELIMINATED ALTERNATIVES

Project and Alternatives	Companies Involved	Appli. Pipe Requirements (mileage, diameter, new or looped)	Appli. Compression Requirements (station name, new, existing, location, hp)	Appli. Estimated Cost in Millions	FERC Staff's Calculated Pipe Requirements	FERC Staff's Calculated Compression Requirements	FERC Staff Est Cost Total System ($ millions)	Additional[2] Cost Above Kern River ($ millions)	Recommendations (screening criterion)
East Utah Alternative with Kern River (Newcastle Route)	Kern River	737.0 mi 36" new 75.0 mi 30" new	Vernal (new) 27700 hp Kingston (new) 9100 hp #5 (new) 9900 hp	$804.5	same as appli. same as appli.	same as appli. same as appli.			E-4 see Sec. 2.6.4.2
	Northwest	130.0 mi 36" loop 62.0 mi 30" lat.	Green River 2000 hp others modifica.	$171.9			$976.4	$151.7	
Central Nevada Alternative	Kern River	792.0 mi 36" new 75.0 mi 30" new	Burley (new) 29000 hp White Pine (new) 11400 hp Bishop (new) 11700 hp	$880.9	same as appli.	same as appli.			E-2 see Sec. 2.6.2.2
	Northwest	248.0 mi 30" loop 62.0 mi 30" lat.	Muddy Creek 5243 hp others modifica.	$247.0	same as appli.	Muddy Creek 7008 hp	$1103.4	$278.7	
Northern Systems Alternative A	Northwest	279.0 mi 30" loop 236.0 mi 24" loop 62.0 mi 30" lat.	Stanfield (new) 3500 hp	$424.6	355.8 mi 36" loop 159.3 mi 24" loop 62.0 mi 30" lat.	9179 hp			E-3 see Sec. 2.6.2.2
	PG&E	548.0 mi 36" loop 55.0 mi 30" loop 9.0 mi 36" repl.	none	$315.0	same as appli.	none			
	PGT	none	Stanfield (new) 10000 hp	$229.0	none	same as appli.	$960.8	$136.1	
Northern System Alternative B	Kern River	534.0 mi 36" new 42.0 mi 30" new	Ore/Ca Border (new) 28700 hp Stanfield (new) 13200 hp	$676.6	same as appli.	same as appli.			E-2 see Sec. 2.6.2.2
	Northwest	279.0 mi 30" loop 236.0 mi 24" loop 62.0 mi 30" lat.	Stanfield (new) 3500 hp	$424.6	355.8 mi 36" loop 159.3 mi 24" loop 62.0 mi 30" lat.	9,179 hp			
	PGT	327.0 mi 36" loop	Stanfield (new) 10000 hp	$290.0	same as appli.	same as appli.	$1383.4	$558.7	

1/ - Estimated costs without the unknown category; 2/ - Based on FERC staff's estimated costs

Table 2.6-1 (continued)

KERN RIVER GAS TRANSMISSION COMPANY PROPOSAL AND ELIMINATED ALTERNATIVES

Project and Alternatives	Companies Involved	Appli. Pipe Requirements (mileage, diameter, new or looped)	Appli. Compression Requirements (station name, new, existing, location, hp)	Appli. Estimated Cost in Millions	FERC Staff's Calculated Pipe Requirements	FERC Staff's Calculated Compression Requirements	FERC Staff Est Cost Total System ($ millions)	Additional[2/] Cost Above Kern River ($ millions)	Recommendations (screening criterion)
Southern Systems Alternative A-1	Northwest	439.0 mi 36" loop 62.0 mi 30" lat.	Cisco (new) 8330 hp Cahone(new) 9412 hp Ignacio 5243 hp Moab 920 hp Rangley 1020 hp	$511.0	228.3 mi 36" loop 210.7 mi 42" loop 62.0 mi 30" lat.	18495 hp			E-6 see Sec. 2.6.6.1
	El Paso	122.3 mi 34" new 289.5 mi 34" loop	Bondad(new)10600 hp White Rock 10600 hp	$282.5	335.0 mi. loop	36522 hp			
	PG&E	Existing facilities	Existing facilities	N/A	none	Danby 17,000 hp	$731.4	-$99.3	
	SoCalGas	Existing facilities	Existing facilities	N/A	17 mi 24" new	none			
Southern Systems Alternative A-2	Northwest	439.0 mi 36" loop 62.0 mi 30" lat.	same as Alt. 1	$511.0	228.3 mi 36" loop 210.7 mi 42" loop 62.0 mi 30" lat.	18495 hp			E-6 see Sec. 2.6.6.1
	El Paso	122.3 mi 34" new 22.6 mi 34"loop	same as Alt. 1	$104.2	118.2 mi 34"/36" loop	7615 hp			
	Trans-western	unknown	unknown	unknown	228.8 mi 30"/36" loop	79475 hp			
	PG&E	Existing facilities	Existing facilities	N/A	none	Danby 17,000 hp	$782.4	-$42.3	
	SoCalGas	Existing facilities	Existing facilities	N/A	17 mi 24" new	none			
Southern System Alternative A-3	Northwest	439.0 mi 36" loop 62.0 mi 30" lat.	same as Alt. 1	$511.0	228.3 mi 36" loop 210.7 mi 42" loop 62.0 mi lateral				E-6 see Sec. 2.6.6.1
	El Paso	122.3 mi 34" new 22.6 mi 34" loop 71.4 mi loop	same as Alt. 1	unknown	190.7 mi 30"/36"/34"loop	22776 hp			
	Trans-western	unknown	unknown	unknown	199 mi 30" loop				
	PG&E	Existing facilities	Existing facilities	N/A	none	Danby 17,000 hp	$756.7	-$68	
	SoCalGas	Existing facilities	Existing facilities	N/A	17 mi 24" new	none			

1/ - Estimated costs without the unknown category; 2/ - Based on FERC staff's estimated costs

Table 2.6-1 (continued)
KERN RIVER GAS TRANSMISSION COMPANY PROPOSAL AND ELIMINATED ALTERNATIVES

Project and Alternatives	Companies Involved	Appli. Pipe Requirements (mileage, diameter, new or looped)	Appli. Compression Requirements (station name, new, existing, location, hp)	Appli. Estimated Cost in Millions	FERC Staff's Calculated Pipe Requirements	FERC Staff's Calculated Compression Requirements	FERC Staff Est Cost Total System ($ millions)	Additional[2] Cost Above Kern River ($ millions)	Recommendations (screening criterion)
Southern Systems B Alternative	Kern River	260.0 mi 36" new 75.0 mi 30" new	Topock 11000 hp (new)	$310.4	same as appli.	same as appli.			
	Northwest	439.0 mi 36" loop 62.0 mi 30" lat.	same as Alt. A-1	$511.0	228.3 mi 36" loop 210.7 mi 42" loop 62.0 mi 30" lat	18495 hp	$1017.7	$193	E-2 see Sec. 2.6.6.2
	El Paso	289.5 mi 34" loop 122.3 mi 34" loop	same as Alt. A-1	$282.5	335.0 mi loop	36522 hp			
North-South Systems A Alternative	Northwest	393.0 mi 24" loop 46.0 mi 26" loop 62.0 mi 30" lat.	Cisco (new) 5229 hp Cahone(new) 5831 hp Ignacio 2622 hp Stanfield 1000 hp	$330.5	182.3 mi 24" loop 46.0 mi 26" loop 210.7 mi 36" loop	8698 hp			
	El Paso	18.2 mi 30" loop 38.2 mi 34" loop 35.6 mi 30" loop	Bondad 10600 hp (new)	$69.1	137.5 mi 30"/34" loop	22321 hp			E-6 see Sec. 2.6.6.2
	PGT	Existing facilities	Existing facilities	N/A	none	none			
	PG&E	Existing facilities	Existing facilites	N/A	none	none			
	PG&E/ SoCalGas	Existing facilities	Existing facilities	N/A	17 mi 24" new		$418	$-406.7	
North-South Systems B Alternative	Northwest	same as A	same as Alt. A	$330.5	same as Alt. A	8698 hp			
	El Paso	56.4 mi 34" loop 5.5 mi 30" loop	same as Alt. A	$48.1	65 mi 34" loop	7160 hp			
	Trans-western	Unknown	unknown	Unk.	198.8 mi 30" loop	none			E-6 see Sec. 2.6.6.2.2
	PGT	Existing facilities	Existing facilities	N/A	none	none			
	PG&E	Existing facilities			none	none	$475.9	-$348.8	
	PG&E & SoCalGas	Existing facilities	Existing facilities	N/A	17 mi 24" new	none			

1/ - Estimated costs without the unknown category; 2/ - Based on FERC staff's estimated costs

Table 2.6-1 (continued)
KERN RIVER GAS TRANSMISSION COMPANY PROPOSAL AND ELIMINATED ALTERNATIVES

Project and Alternatives	Companies Involved	Appli. Pipe Requirements (mileage, diameter, new or looped)	Appli. Compression Requirements (station name, new, existing, location, hp)	Appli. Estimated Cost in Millions	FERC Staff's Calculated Pipe Requirements	FERC Staff's Calculated Compression Requirements	FERC Staff Est Cost Total System ($ millions)	Additional[2] Cost Above Kern River ($ millions)	Recommendations (screening criterion)
North-South Systems C Alternative	Northwest	393.0 mi 24" loop 46.0 mi 26" loop 62.0 mi 30" lat.	Cisco (new) 5229 hp Cahone (new)5831 hp Ignacio 2622 hp Stanfield 1000 hp	$330.5	182.3 mi 24" loop 46.0 mi 26" loop 210.7 mi 36" loop	8,698 hp	$434.2	-$390.5	E-6 see Sec. 2.6.6.2
	El Paso	54.6 mi 34" loop 5.5 mi 30" loop	Bondad 10,600 hp	$48.1	65.0 mi 34" loop	7,160 hp			
	Trans-western	unknown	unknown	Unk.	132.6 mi 30" loop	None			
	PGT	Existing facilities	Existing facilities	N/A	None	None			
	PG&E	Existing facilities	Existing facilities	N/A	None	None			
	PG&E & SoCalGas	Existing facilities	N/A	N/A	17.0 mi 24" new	None			
Weber River Variation	Kern River	771.4 mi 36" new 75.0 mi 30" new	(All New) #1 18200 hp #3 9100 hp #5 9900 hp	$830.7	same as appli.	same as appli.	$830.7	$6.0	E-4 see Sec. 2.6.4.3
Sevier-Escalante Desert Variation	Kern River	780.5 mi 36" new 75.0 mi 30" new	(All New) #1 18200 hp #3 9100 hp #5 9900 hp	$852.1	same as appli.	same as appli.	$852.9	$28.2	E-4 see Sec. 2.6.4.4
Chevron Oil Variation (Pines Route)	Kern River	892.0 mi 36" new 75.0 mi 30" new	(All New) #1 18200 hp #3 9100 hp #5 11300 hp	$955.9	same as appli.	same as appli.	$955.9	$131.2	E-3 see Sec. 2.6.2.2
Chevron Oil Variation (Nephi Route)	Kern River	882.0 mi 36" new 75.0 mi 30" new	same as 9(G)	$940.5	same as appli.	same as appli.	$940.5	$115.8	E-3 see Sec. 2.6.2.2
Chevron Oil Variation (Newcastle Route)	Kern River	872.0 mi 36" new 75.0 mi 30" new	same as 9(G)	$935.6	same as appli.	same as appli.	$935.6	$110.9	E-3 see Sec. 2.6.2.2

1/ - Estimated costs without the unknown category; 2/ - Based on FERC staff's estimated costs

Table 2.6-1 (continued)
KERN RIVER GAS TRANSMISSION COMPANY PROPOSAL AND ELIMINATED ALTERNATIVES

Project and Alternatives	Companies Involved	Appli. Pipe Requirements (mileage, diameter, new or looped)	Appli. Compression Requirements (station name, new, existing, location, hp)	Appli. Estimated Cost in Millions	FERC Staff's Calculated Pipe Requirements	FERC Staff's Calculated Compression Requirements	FERC Staff Est Cost Total System ($ millions)	Additional[2] Cost Above Kern River ($ millions)	Recommendations (screening criterion)
Intermountain Power Project Variation (North Route)	Kern River	795.0 mi 36" new 75.0 mi 30" new	(All #1 18200 hp New) #3 9100 hp #5 10600 hp	$865.3	same as appli.	same as appli.	$865.3	$40.6	E-4 see Sec. 2.6.4.5
Intermountain Power Project Variation (South Route)	Kern River	780.0 mi 36" new 75.0 mi 30" new	(All #1 18200 hp New) #3 9100 hp #5 9900 hp	$851.3	same as appli.	same as appli.	$851.3	$26.6	E4 see Sec. 2.6.4.6
North Las Vegas Var. with the California Spur	Kern River	769.2 mi 36" new 75.0 mi 30" new	(All #1 18200 hp New) #3 9100 hp #5 9700 hp	$833.4	same as appli.	same as appli.	$833.4	$8.7	E-5 see Sec. 2.6.5.1
Sanpete Valley Variation	Kern River	784.0 mi 36" new 75.0 mi 30" new	(All #1 18200 hp New) #3 9500 hp #5 10400 hp	$840.7	same as appli.	same as appli.	$840.7	$16.0	E-4 see Sec. 2.6.4.7
Tejon Canyon Variation	Kern River	760.3 mi 36" new 75.0 mi 30" new	(All #1 18200 hp New) #3 9100 hp #5 9900 hp	$823.1	same as appli.	same as appli.	$823.1	-$1.6	E-5 see Sec. 2.6.5.2
Sunrise Mountain Corridor Variation	Kern River	737.2 mi 36" new 75.0 mi 30" new	(All #1 17000 hp New) #3 9000 hp #5 9500 hp	$824.9	same as appli.	same as appli.	$824.9	N/A	E-5 see Sec. 2.6.5.2
Sunrise Mountain-Lake Mead Variation	Kern River	739.2 mi 36" new 75.0 mi 30" new	(All #1 17000 hp New) #3 9000 hp #5 9500 hp	$827.0	same as appli.	same as appli.	$827.0	N/A	E-5 see Sec. 2.6.5.2
Sunrise Mountain-Rainbow Gardens Variation	Kern River	740.6 mi 36" new 75.0 mi 30" new	(All #1 17000 hp New) #3 9000 hp	$828.5 $828.5	same as appli.	same as appli.	$828.5	N/A	E-5 see Sec. 2.6.5.2

1/ - Estimated costs without the unknown category; 2/ - Based on FERC staff's estimated costs

Similarly, El Paso's testimony filed October 1 indicated that operating conditions on the porion of its mainline system between west Texas and California had changed such that significantly more capacity was now available. Because its testimony did not revise facility requirements for alternatives previously evaluated in the FERC staff study, data presented in Table 2.6-1 concerning pipe and compression requirements for El Paso's system should be considered as worst-case requirements; in most instances, these requirements could be reduced.

In general, company-supplied data was used in the text of Section 2.6. As reflected in Table 2.6-1, the vast majority of the information provided by the various pipeline companies was independently verified by the FERC staff. In those relatively rare instances when minor discrepancies arose, the data used in the analysis was chosen on a case-by-case basis. In the broader comparisons conducted under environmental criterion E-6, worst-case facility requirements were considered.

2.7.1 Systems Flexibility (E-1)

The first screening criterion, E-1, is based on flexibility of the overall transportation system and is relevant only to alternatives which involve outside pipeline systems not associated with the EOR projects. This screening criterion requires that alternatives offer adequate system flexibility to meet the goals of the project in terms of deliverability and reliability. Practical alternatives cannot involve a pipeline company which has expressed a clear disinterest in participating in the alternative. Based on this criterion, five alternatives were eliminated from detailed analysis.

2.7.1.1 Mountain Fuel Resources/Overthrust Alternative

Under Alternative A, MFR would have transported volumes of gas delivered by Northwest westward through its mainlines 1, 13, and 15 to Kern River where these lines intersect Kern River's proposed route east of Upton, Utah. Overthrust Belt gas proposed for collection by Kern River along its system north of Upton would have been collected along MFR's existing gathering and transmission facilities in this area and transported south (through the MFR mainlines 36, 48, and 57) then west (through mainlines 1, 13, and 15) for delivery to Kern River near Upton.

Table 2.6-1 provides a number of data categories concerning the mileages and diameters of new or looped pipeline, compression requirements, and costs estimated by both the respective pipeline company and the FERC staff. Based on this table, Alternative A could result in a net facilities change of 30.2 miles of additional pipe and 8,621 hp of additional compression.

MFR's response to a FERC staff data request indicated that it was unlikely that Alternative A could yield any economic advantage compared to the Kern River pipeline project. [6] Three reasons for the assessment were given: 1) the MFR transmission system does not currently possess sufficient capacity between Upton, Utah, and the Northwest delivery point in Sweetwater County, Wyoming, to transport the required volumes of gas for Kern River; 2) the requisite MFR system reinforcements needed to enable operation as contemplated in Alternative A would equal or exceed the facilities proposed by Kern River between Opal and Upton; and 3) on the basis of flow diagrams submitted by Northwest, MFR engineering personnel believe that Northwest would need to undertake major reinforcements of its transmission system between Opal and the Sweetwater interconnection to enable operation as contemplated.

This response from MFR was considered as an expression of clear disinterest in participating in the alternative. The alternative was therefore eliminated from detailed analysis based on criterion E-1.

Under Alternative B, MFR would have delivered a portion of the gas received from Northwest by displacement to Wyoming Interstate Company, Ltd. and/or Colorado Interstate Gas Company (CIG) at existing interconnections near Rock Springs in Section 24, T18N, R111W, Sweetwater County, Wyoming. In exchange, Overthrust Pipeline Company (OPC) would have provided equivalent gas volumes to MFR at an existing interconnection in the Whitney Canyon area, T17N, R119W, Uinta County, Wyoming. MFR would then deliver the exchange gas, as well as Overthrust Belt gas collected along its system in this area, to Kern River near Upton by means identified in Alternative A. Implementation of this alternative would require 9.4 miles less pipeline and 19,221 hp more compression than the Kern River proposal.

The MFR data response stated a number of reasons why the project would not be feasible using MFR's system. OPC also stated that both alternatives suggested by the FERC staff were not feasible. [7] Finally, a letter from CIG stated that while Alternative B would have little, if any, significant impact on CIG, it concurred with the OPC response that the alternatives suggested would not constitute viable alternatives to Kern River's proposal. [8]

---

[6] L.F. Gill, Vice President of Regulatory Affairs, MFR, Letter to the Secretary of the FERC dated January 23, 1986.

[7] A.J. Marushack, Management Committee Chairman, OPC, Letter to the Secretary of the FERC dated January 23, 1986.

[8] J.E. Collier, Assistant Vice President, CIG, letter to the Secretary of the FERC dated February 3, 1986.

The responses from these pipeline companies were considered as expressions of clear disinterest in participating in the alternative. The Mountain Fuel Resources/Overthrust Alternatives were therefore eliminated based on criterion E-1.

2.7.1.2 East Utah Alternatives

These three alternatives would have substituted a combination of existing and/or upgraded regional pipeline systems or a new pipeline along existing and/or proposed utility corridors for major portions of Kern River's proposed route between its interconnection with Northwest near Opal, Wyoming, and the area north of Newcastle in Iron County, Utah. While the routes are collectively referred to as the East Utah Alternatives, they are individually differentiated on the basis of where they terminate, i.e., the Pines Route, the Nephi Route, and the Newcastle Route.

From Northwest's mainline southeast of Vernal, all three alternatives would have followed an existing Northwest lateral into the Greater Red Wash area to an existing interconnection with MFR mainline 40 in T1N, R22E, Uinta County, Utah. Once the proposed 700 MMcfd was delivered to MFR mainline 40, the alternatives became distinct.

Using the Pines Route, MFR would have transported the gas westward through its mainlines 40 and 41 for redelivery to Kern River where the MFR mainline 41 intersects the Kern River route near Pines, Utah County, Utah. Table 2.6-1 indicates that this alternative would result in a net facilities change of an additional 191 miles of pipeline with an additional 40,800 hp of compression. This resulted in a cost increase of $84.7 million above Kern River's proposal.

Using the Nephi Route, MFR would have transported the gas west from the Red Wash area through its mainline 40 to a point about 20 miles northeast of Price, Utah, where an interconnection with Kern River would be established. At this point, Kern River would have constructed its pipeline along a new route heading west and north to Soldier Summit, then west and south past Indianola to an intersection with its proposed route east of Nephi in T13S, R2E, Juab County, Utah. This alternative would result in a net facilities change of an additional 178 miles with an additional 26,800 hp of compression (Table 2.6-1). These differences, coupled with the addition of facilities by Northwest and MFR, would result in a cost increase of $132.2 million above the Kern River proposed action.

The Newcastle Route would have been identical to the Pines Route until the gas reached T14S, R9E, Carbon County, west of Price, Utah. A Kern River interconnection would be established near the junction of MFR's mainlines 40 and 44. Kern River would have constructed its pipeline along a new route heading south and west initially adjacent to MFR's mainline 44 to Ferron in T20S, R7E, Emery County, Utah, and later along existing and proposed utility and/or highway corridors past Emery and Fremont (Wayne County) to Circleville (Piute County). The new route would have then headed west and south to an intersection with Kern River's proposed route northeast of Newcastle in T34S, R14W, Iron County, Utah. This alternative would result in a net facilities change of an additional 172 miles and an additional 30,500 hp in compression when compared to the Kern River proposal (Table 2.6-1). However, due to increases in the miles of looping and compression for both the Northwest and MFR system, the alternative would cost approximately $108.1 million more than the Kern River proposal.

MFR's response to a FERC data request indicated that the East Utah Alternative (Pines Route) was unlikely to yield any economic advantage. The principal reasons underlying the assessment were: 1) there is not sufficient capacity in MFR's southern transmission system between Red Wash and the Pines, Utah, delivery point to transport the required volumes of gas for Kern River; 2) the estimated cost of the requisite MFR system reinforcements needed to enable operation as contemplated exceeds the cost of the facilities proposed by Kern River between Opal and Pines; and 3) MFR engineering personnel believe that Northwest would need to undertake major reinforcement of its transmission system in order to operate as contemplated.

MFR indicated that the Nephi Route was also unlikely to yield any economic advantage for the same reasons discussed above. Finally, when the Newcastle Route was compared to the Nephi Route, MFR estimated additional miles of pipeline and compression changes which "from MFR's perspective...[makes the Newcastle Route] even less attractive than [the Nephi Route]".

These responses from MFR were considered as an expression of clear disinterest in participating in the alternatives. Based on these statements, the East Utah Alternatives were eliminated from further analysis under criterion E-1. In addition to E-1, the Nephi and Newcastle Routes could also have been eliminated using criterion E-3 which eliminates an alternative if it exceeds an additional capital cost of $100 million (see Table 2.6-1 and the discussion of Criterion E-3 in Section 2.6.3).

2.7.2 Economic Feasibility (E-2)

The second screening criterion, E-2, involves economic feasibility. This screen was used to determine if any system or route alternative or variation exceeded an initial capital cost of $1 billion, which equates to roughly 20 percent additional project cost over the Kern River cost of $824.7 million. It is felt that this cost increase would render the project, and therefore any alternative, economically inviable. Using this screening criterion, four alternatives were eliminated.

2.7.2.1 West Salt Lake Alternative

This alternative would have followed a route identified in the RMPP FEIS as the West Salt Lake Alternative, extending between Northwest's mainline system in Bear Lake County, Idaho, and Kern River's proposed route in T20S, R4W, Millard County, Utah. While the RMPP alternative was proposed to interconnect with Northwest's mainline in T13S, R44E, near Montpelier, any point along Northwest's system between Montpelier and eastern Twin Falls County was considered. Because the alternative would have completely circumvented the Overthrust Belt area of Wyoming and Utah, it required that existing and/or new facilities owned by Northwest and/or others be identified to deliver the Overthrust Belt gas to Kern River.

As indicated in Table 2.6-1, this alternative would have required an increase of 265 miles of pipeline and an increase of 18,843 hp of compression over the Kern River proposal. The FERC staff estimated the cost of the alternative at $1.044 billion, an increase of $219.6 million over the cost of the Kern River proposal. Because this increase exceeds the level identified in Criterion E-2, the West Salt Lake Alternative was eliminated from detailed study. In addition to the E-2 criterion, the alternative raised a number of environmental concerns which would have resulted in its elimination under criterion E-5 (discussed in Section 2.6.5).

2.7.2.2 Central Nevada Alternative

This alternative would have extended between a point on Northwest's mainline system in southern Idaho and the Kern River route in T10N, R6W, San Bernardino County, California, using a portion of the route identified in the RMPP FEIS as the Central Nevada Alternative. While all Canadian gas destined for the proposed Northwest/Kern River interconnection near Opal, Wyoming, must pass through this portion of Northwest's system, the alternative would also have required Northwest to collect and transport the Overthrust Belt gas to southern Idaho. The alternative would relocate the starting point of the Kern River pipeline from a location near the Opal, Wyoming, area to a point on Northwest's system near Burley, Idaho. The alternative would intersect the RMPP Central Nevada Alternative near Ely, Nevada, and would proceed along this route to an intersection with Kern River's proposed route at MP 671, Kramer Junction in San Bernardino County, California.

Implementation of this alternative would have resulted in approximately 340 miles of additional pipeline over the proposed Kern River proposed route. Construction by Kern River would have been increased by about 30 miles. Additionally, Northwest would have needed to add 248 miles of looping along its mainline between Opal and Burley, as well as 62 miles of new 30-inch O.D.

lateral pipeline to collect and transport Overthrust Belt gas between southwest Wyoming and its mainline near Opal.

Implementation of this alternative would also have required relocation of the proposed three compressor stations on the Kern River system and significant additional horsepower. The first station would be located at MP 0 near Northwest's Burley Compressor Station and would require 29,000 hp. The second compressor station would be located in White Pine County, Nevada, and would require 11,400 hp. The third compressor station would be located in the Owens Valley near Bishop, California, and would require 11,700 hp. Northwest would require 5,243 hp of additional compression at its Muddy Creek station as well.

These compression changes amount to an increase of 20,143 hp over the original Kern River proposal. According to FERC staff estimates, this increase, coupled with an additional 340 miles of pipeline, would place the estimated cost of the alternative at $1.103 billion, an increase of $278.7 million over the cost of the Kern River proposal. Because these cost increases were in excess of the 20 percent level identified in criterion E-2, the Central Nevada Alternative was eliminated from detailed study.

2.7.2.3 Northern Systems Alternative B

This alternative would have relocated Kern River's entire route from its proposed location to one extending between Malin, Oregon, near the Oregon/California border and the Bakersfield area in southern California. Under this alternative, Northwest would have delivered the Canadian gas to PGT at an existing interconnection at Stanfield, Oregon. The Overthrust Belt gas would have been transported north on Northwest's system for delivery to PGT at Stanfield. The full 700 MMcfd would then be transported by PGT to southern Oregon, where an interconnection would have been established with Kern River near Malin.

To deliver the required volume of gas to the interconnection with PGT at Stanfield, Oregon, Northwest would have been required to add approximately 279 miles of 30-inch and 236 miles of 24-inch mainline looping and upgrade numerous compressor stations. In addition, Northwest would be required to build a 62-mile-long 30-inch lateral to collect and transport Overthrust Belt gas which was referenced in Section 2.6.2.2. The PGT system would also have required expansion by 327 miles of 36-inch loop and a new compressor station at the Stanfield interconnection.

This alternative would also require Kern River to build approximately 534 miles of mainline from the California/Oregon border to the Bakersfield area and 42 miles of delivery laterals at Bakersfield.

Facilities needed to implement this alternative are summarized in Table 2.6-1. Kern River would have required 261 fewer miles of pipeline; however, 904 miles would be necessary by Northwest and PGT. Kern River would have to increase compression by 4,700 hp, but construct one less compressor station. Northwest would have needed to build one 3,500 hp station and PGT would have required a new station at Stanfield with 10,000 hp.

These increases in pipeline miles and compression placed the estimated cost of the alternative at $1.383 billion, an increase of $558.7 million over the cost of the Kern River proposal. These cost increases are in excess of 20 percent of the cost of the Kern River proposal and made the alternative economically infeasible. Based on these data, the alternative was eliminated from detailed study. The alternative also had potential environmental constraints which would preclude further study based on screening criteria E-4 and E-5.

2.7.2.4 Southern Systems B Alternative

The alternative would have substituted a combination of existing pipeline systems and system upgrades for a major portion of Kern River's proposal. Under this alternative, the full 700 MMcfd of natural gas would have been transported to the southernmost point on Northwest's mainline system at Ignacio, Colorado, and then transported by El Paso to western Arizona where an interconnection would have been established with Kern River near Topock.

This alternative would require Kern River to build approximately 260 miles of 36-inch mainline from the Arizona/California border to the Bakersfield area, and 75 miles of 30-inch laterals near Bakersfield. Kern River would require one 11,000 hp compressor station near the Topock interconnection.

To deliver the required volume of gas to El Paso at Ignacio, Northwest would have to add approximately 439 miles of 36-inch mainline looping and upgrade seven compressor stations. In addition, Northwest would have to build the 62-mile-long 30-inch lateral previously described in order to transport Overthrust Belt gas from southwestern Wyoming into Northwest's mainline. This alternative would require new compressor stations at Northwest MP 68 (Cahone) and MP 196 (Cisco). Additional compression would be required at the Ignacio station. Station modification consisting of restaging or recylindering would be required at the Green River and Vernal Stations to increase flow capabilities.

To deliver the required volume of gas to Kern River at the Arizona/California border El Paso would have to add approximately 412 miles of 34-inch mainline looping, upgrade seven compressor stations, and construct two new compressor stations at Bondad and White Rock. Approximately 122 miles of 34-inch looping pipeline would have to be constructed between Ignacio, Colorado, and Valve City, near Gallup, New Mexico. In addition, 285.5 miles of 34-

inch mainline looping would be required from north of Valve City and Topock, Arizona. New compressor stations would be constructed adjacent to the existing Bondad and White Rock Stations. Each station would consist of two turbines (SC) rated at 5,300 hp (ISO) each. Compressor station modifications would be required at Leupp C, Seligman B, Hackberry B, Flagstaff, Williams, Seligman A, and Wenden.

These increases in pipeline miles (410.8 miles) and compression (19,925 hp) placed the estimated cost of the alternative at $1.018 billion, an increase of $193 million over the cost of the Kern proposal. These cost increases are in excess of 20 percent of the cost of the Kern River proposal and made the alternative economically infeasible under criterion E-2. Based on these data, the alternative was eliminated from detailed study. The alternative also had potential environmental constraints which would preclude further study based on screening criteria E-4 and E-5.

2.7.3 Economic Feasibility (E-3)

The third screening criterion for alternative analysis also involves economic feasibility. This screen, E-3, was used to determine if any system or route alternative or variation exceeded an additional capital cost of $100 million, which is equal to roughly 10 percent of the base project cost. Additional costs associated with route alternatives or variations in general represent costs which could be applied to environmental mitigation on the proposed route. An expenditure of this magnitude (i.e., 10 percent of the base project cost) for environmental mitigation is felt to be excessive. It is felt that environmental concerns associated with the proposed route (which the alternative is designed to resolve) could be mitigated directly at less cost. This level of additional cost would also seriously jeopardize the economic viability of the alternative. Under this screening criterion, six alternatives were eliminated from further review.

2.7.3.1 East Utah Alternative with Kern River Building Along the Pines or Nephi Routes

Under these two alternatives Kern River would have built its proposed pipeline along the MFR routes discussed in Section 2.6.1.2. Table 2.6-1 lists the facilities that would be needed to construct these alternatives. Overall, the Pines Route would have required an additional 187 miles of pipe and 14,100 hp of compression. The Nephi Route would have required an additional 177.6 miles of pipeline and 14,100 hp of compression.

Both alternatives exceed the 10 percent screening level established under criterion E-3. The Pines Route would have cost approximately $1006.1 million, $181.4 million more than the Kern

River proposal. The Nephi Route was estimated at $991.9 million, $167.2 million more than the Kern River proposal. Because cost increases for both would have been greater than $100 million, both of these alternatives were eliminated from detailed study.

2.7.3.2 Northern Systems Alternative A

As with the Northern Systems Alternative B, this alternative would have had Northwest delivering both the Canadian and Overthrust Belt volumes to PGT at an existing interconnection at Stanfield, Oregon. PGT would then have delivered the full 700 MMcfd to PG&E's mainline facilities at an existing interconnection on the Oregon/California border for subsequent shipment to the Bakersfield area.

Routing locations and facilities for Northwest were outlined in Section 2.6.2.3. Table 2.6-1 indicates that Northwest would have required 577 miles of new pipeline and looping, and 3,500 hp of compression. Estimated costs for construction were $424.6 million.

PG&E would have been required to loop 612 miles of its existing system at a cost of $315.0 million. PGT would have to construct a new 10,000 hp compressor station at Stanfield, Oregon, at an estimated cost of $229.0 million.

Total costs for the alternative were estimated at $960.8 million, a net cost increase of $136.1 million over the proposed Kern River project. Because these cost increases exceeded the $100 million level identified by screening criterion E-3, the Northern System Alternative A was eliminated from further detailed analysis.

2.7.3.3 Chevron Oil Variations

As with the East Utah Alternatives, these three variations are differentiated on the basis of where they terminate, i.e., the Pines Route, the Nephi Route, and the Newcastle Route. All three variations would have diverged from the Kern River route in the area of the Provo River crossing southeast of Francis, Utah. Here the variations followed an existing Chevron Oil Company pipeline corridor heading southeast to the area of Myton, Duchesne County. The variations would here turn due south following an existing MFR corridor to its junction with the MFR Mainline 40 corridor midway between the Greater Red Wash area and Price. Each variation would then have proceeded westward by following the appropriate portion of the East Utah Alternatives as presented in Section 2.6.1.2.

The Pines Route would have required construction of 189 miles of pipeline between Francis and Pines versus the 59 miles between the same two points along Kern River's proposed route, a net increase change of 130 miles. Compression requirements and locations of compressor stations would also have to be made. Compressor Station No. 1 would be the same as proposed for the primary route. The second compressor station calculated to require 9,100 hp, would be located in the southern portion of the Uinta Basin. A third compressor station would require 11,300 hp and would be located in the Dixie National Forest. This would result in a net increase of 1,400 hp. Estimated costs for the construction of this variation were $955.9 million, $131.2 million more than the Kern River proposal.

The Nephi Route would have required an additional 120 miles of pipeline and 1,400 hp of compression. Its estimated cost of construction would be $940.5 million, a $115.8 million increase over the Kern River proposal.

Utilizing the Newcastle Route would result in 348 miles of pipeline construction versus the 238 miles along the Kern River route, or a net increase of 110 miles of pipeline construction. An additional 1,400 hp of compression would also be necessary. The Newcastle Route had an estimated construction cost of $935.6 million, an increase of $110.9 million over the cost of the Kern River proposal.

All three of the Chevron Oil Variations had estimated costs which exceed the estimated cost of the Kern River proposal by more than $100 million. On this basis, the variations were eliminated from further detailed analysis under screening criterion E-3.

2.7.4 Environmental and Economic Concerns (E-4)

The fourth screening criterion developed for alternative analysis involved both environmental and economic advantages. Screen E-4 was used to determine if any remaining system or route alternatives or variations exceeded by 10 percent or more the capital cost of the portion of the proposed route which it avoided. It is felt that for this increase in cost, the alternative must offer clear and significant environmental advantages over the proposed route. Lacking such advantages, the alternative was dropped from further consideration. Application of E-4 resulted in the elimination of seven alternatives from further consideration.

2.7.4.1 Sage Junction Alternative

This alternative would have used the original RMPP route from MP 0 at its interconnection with the mainline facilities of Northwest near the Utah/Wyoming border in the extreme western portion of T22N, R120W, Lincoln County, Wyoming, to its intersection near RMPP MP 65 with the Kern River route in T5N, R8E, Summit County, Utah.

This alternative would have substituted that portion of the proposed RMPP alignment between Sage Junction, Wyoming, and the Porcupine Ridge area of Summit County, Utah, for the first 67 miles of Kern River's proposed route. This results in an alignment 65 miles in length as compared to 67 miles along Kern River's proposed route between the same two points, or a decreased distance of about two miles.

An investigation of this proposed alternative using available 1:250,000 scale mapping indicates that 22 miles are in relatively flat terrain with some congestion due to facilities of other utilities in the area. The remaining 43 miles was characterized by rolling to choppy terrain, particularly in the southern end, where some soil stability problems may be expected. The alternative would follow an existing highway between RMPP MP 0 and Woodruff, Utah, where MFR has built facilities.

The alternative would have created more severe surface disturbance as compared to the primary route. Approximately 40 miles of the alternative would parallel the Bear River and interrelated drainages. Potential impacts to wetland/riparian areas, including 23 miles of waterfowl areas, may occur throughout this portion of the alternative route. Kern River's proposed route would impact approximately eight miles of wetland/riparian areas.

In addition to these impacts along the alternative route, Northwest would have to construct 39.7 miles of 24-inch loop along its mainline between the areas of Opal and Sage Junction and 62.0 miles of 30-inch lateral from the Overthrust Belt gas fields to the Opal area.

Northwest indicates that archaeological and wildlife concerns would be adversely affected. The area of southwestern Wyoming affected by this alternative is rich in cultural and historical significance. The Green River Formation which outcrops in the vicinity of the Kemmerer Compressor Station yields significant paleontological resources. This area, including the Fossil Butte National Monument, is managed by the NPS. The BLM considers the sage grouse to be a sensitive species in this area. Surface disturbing activities could be restricted where sage grouse strutting and breeding grounds are encountered along the route. Potential black-footed ferret habitat exists in the vicinity of the looping that this alternative would require. 9/

Kern River compression requirements for implementing this alternative would include the installation of 17,900 hp for Compressor Station No. 1 at a new site where the alternative would have interconnected with Northwest's system near Sage Junction. In comparison, the presently proposed site for Kern

---

9/ Harold L. Talisman, Attorney for Kern River, Letter to Commission Staff Counsel filed January 10, 1986.

River's Compressor Station No. 1 is located adjacent to the existing Northwest Muddy Creek Compressor Station. This location would eliminate the need for new access roads and other facilities. Compressor Stations No. 3 and 5 would remain the same as proposed for the primary route.

The environmental issues discussed above can be attributable to the increased miles of surface disturbance. Although the Kern River route would only be decreased by 2.0 miles, an additional 101.7 miles of pipeline would need to be constructed by Northwest. The cost of this alternative would be $895 million, an increase of $70.3 million over the proposed Kern River route. When compared with the cost estimated for the first 67 miles of Kern River's proposed route, this represented a 51 percent increase with no significant environmental advantage to offset this cost. This increased cost, coupled with the impact associated with an additional 102 miles of surface disturbance, cannot be justified on either environmental or economic grounds. The Sage Junction alternative was therefore dropped from further detailed analysis.

2.7.4.2 . East Utah Alternative with Kern River Building Along the Newcastle Route

This route alternative would have been in the same location as the Newcastle alternative described in Section 2.6.1.2, except that Kern River would have constructed the 112 miles of 36-inch pipe which was required by MFR. As with that alternative, Kern River would also build the 312 miles of pipe required between Ferron and near MP 337 on Kern River's proposed route in the Newcastle area. Kern River's project mileage under this alternative would be 812 miles versus 837 miles under Kern River's current proposal, or a reduction of 25 miles.

Environmental and construction considerations with regard to the route are outlined below. From the White River crossing to the beginning of Nine Mile Canyon, rock requiring blasting would be present. Blasting next to an existing pipeline would create problems and would prohibit much of the grading along the ROW which could have alleviated some of the need for overbends and sags. This type of construction would also be necessary in the area of Northwest's Duck Creek, Horseshoe Bend, and Love Gathering Systems.

The upper portion of Nine Mile Creek is in a narrow canyon where MFR's 20-inch pipeline uses the most feasible route. Kern River would have had to build in an agricultural area of the canyon, where many crossings of a meandering creek would have been necessary.

Kern River's paralleling of MFR's mainline 40 from near Red Wash to Price, Utah, would entail crossings of the White and the Green Rivers. Portions of both of these rivers are habitat for one or more of three endangered fish species: the Colorado squawfish, humpback chub, and bonytail chub. In comparison, no endangered fish species have been identified in the portion of the proposed route which this alternative would replace. This alternative would avoid approximately 33 miles of the Uinta National Forest, thereby reducing impact to National Forest lands which would occur on the corresponding portion of Kern River's proposed route.

This alternative would also require acquisition of approximately 16 miles of ROW across the Uintah and Ouray Indian Reservations.

From Price south, this alternative would parallel State Highway 10 through Castle Valley which is considered highly scenic, especially near the crossing of Interstate 70. Numerous perennial and intermittent streams drain this valley and adjoining upper slopes and support riparian vegetation. South of the junction of Interstate 70, the alternative route would enter a proposed utility corridor through approximately 15 miles of Fishlake National Forest. South and west of this area, the alternative would parallel State Highway 62 and would traverse the western side of Otter Creek Reservoir, site of Otter Creek Lake State Beach. The alternative would probably cross the Old Spanish Trail once more than the proposed route. The East Utah Alternative would have more potential to impact recreational and scenic values than that portion of the proposed route directly west of the alternative route in the Sevier and Escalante Deserts.

In addition to the environmental considerations along the Kern River portion of the alternative, Northwest would have needed to loop 130 miles of its system between the Opal and greater Red Wash areas, and construct 62 miles of lateral between Opal and the Overthrust Belt gas fields. Environmental concerns included impact to wildlife and water quality. The BLM considers the sage grouse to be a sensitive species in the affected area. Surface disturbing activities could be restricted where sage grouse strutting and breeding grounds are encountered along the route. Potential black-footed ferret habitat exists in the vicinity of the looping required on Northwest's system. About 23 miles of looping would be constructed in the Flaming Gorge National Recreation Area where expansion of Northwest's existing ROW would be prohibited by the Forest Service. The Green River crossing below Flaming Gorge Dam is within a designated high quality fishing area (Class I), and is also a launch site for commercial raft trips during the summer months. The endangered Colorado River squawfish, the humpback chub, and the bonytail chub have been reported in the Green River below Vernal, Utah, and in the Colorado River. Threatened and endangered plant species that have been identified in the area affected by this alternative include the Uintah Basin hookless cactus and the spineless hedgehog cactus.

All of these environmental factors along the alternative route suggest that the proposed route may cause less damage. Points in favor of the alternative involved impacts to National Forest lands although when compared to the impacts to water quality, endangered plants and animals, and recreational areas the proposed route probably involves fewer impacts. Coupled with the environmental factors is the difficult construction associated with the route north of Price, Utah.

In addition to these factors, the alternative would have required Kern River to relocate all three of its proposed compressor stations and significantly increase power at Station No. 1. The first compressor station would be located near Vernal, Utah, and would require 27,700 hp, 9,500 hp over that required by the primary route. The second compressor station would be located near Kingston, Utah, in Piute County. This location is approximately three miles south of Piute Reservoir in the Sevier River Drainage. The third compressor station would be located approximately five miles south of Kern River's proposed Compressor Station No. 5 near Jean Lake in the Ivanpah Valley, Clark County, Nevada. In addition, Northwest would have to add 2,000 hp of compression at its Green River Station.

The estimated cost to build the Kern River project utilizing this alternative is $804.5 million. The estimated costs of the Northwest facilities associated with this alternative is $171.9 million. The total cost of the project would therefore be $976.4 million, a cost increase of $151.7 million. When compared with the cost estimated for the first 337 miles of Kern River's proposed route, this represented a 45 percent increase which exceeded the level identified in criterion E-4. These increased costs coupled with the environmental concerns discussed caused this alternative to be eliminated because it does not offer clear and significant environmental advantages over the proposed route.

2.6.4.3 Weber River Variation

This variation would have substituted the RMPP route from its intersection with the Kern River route in T2N, R7E, Summit County, to its intersection in T3S, R6E, Wasatch County, Utah. This would involve rerouting the pipeline in the area south of Pine Cliff, Utah (Kern River MP 77), to run almost due west to the town of Coalville. The route would then traverse south along I-80 and the Weber River to the Peoa, Utah area. The route would then run down the Kamas Valley and tie back into the Kern River alignment south of the Provo River crossing near MP 101. This variation would be 33.4 miles long versus the 24 miles of the proposed route, an increase of 9.4 miles of additional surface disturbance. Compressor requirements for the Weber River Variation would remain unchanged from those of the proposed route.

Potential impacts within this increased mileage include a greater likelihood of increasing the sediment load to Chalk Creek and the

Weber River due to construction paralleling the rivers. The Rockport Lake State Park would also be directly impacted by implementation of this variation. Environmental impacts in the Kamas Valley would be similar for both the variation and the primary route.

The cost difference between the variation and the portion of the proposed primary route that is avoided would be $6.0 million, a 39 percent increase in cost. Because of the additional costs of construction and the environmental consequences of additional construction and maintenance activities along local waterways and in the immediate vicinity of a state park, no significant advantage to this variation could be justified. As a result of these environmental and economic factors, this variation was eliminated from detailed analyses using screening criterion E-4.

2.7.4.4 Sevier-Escalante Desert Variation

This variation was based on a route identified in the RMPP FEIS as the Sevier-Escalante Desert Alternative. The variation would diverge from the Kern River route in Section 24, T13S, R3E, Juab County and follow Biglow's Canyon west to MP 0 of the RMPP alternative. It would then follow this route to near MP 128 in T28S, R11W, Beaver County, where it would diverge from the RMPP alternative by proceeding south to parallel an existing telephone ROW in T29S, which intersects with the Kern River route in T30S near MP 308.

Utilization of this variation would result in an increase in mileage and surface disturbance of 18.5 miles. A portion of this additional mileage requires paralleling the Sevier River where it flows from the Juab Valley through Leamington Canyon to the Sevier Desert. As a result, increased impacts to the Sevier River and associated biological communities could be expected. Environmental impacts associated with the remainder of the variation appear to be comparable to those impacts which may occur on the proposed route. One area of exception is that portion of the proposed route which traverses Pinnacle Pass and parallels the foothills of the Mineral Mountains. This portion of the proposed route may reveal a higher density of cultural resources, a higher degree of potential to impact sage grouse strutting grounds, and construction would be constricted due to the Williams Telecommunications cable ROW.

Compressor Stations No. 1 and 5 would not be affected by this variation. Compressor Station No. 3 would be relocated to a point on the variation which is approximately 21 miles north of its location on the proposed route. The estimated cost to construct the Kern River project utilizing the variation would be $852.9 million, a cost increase of $27.4 million over the Kern River proposed route. The cost difference between the variation and that portion of the proposed route avoided represents a cost increase of 14 percent. When viewed in conjunction with the environmental consequences of the additional surface disturbance, the alternative offers no significant environmental advantage over the proposed route and was therefore eliminated from further detailed analysis using criterion E-4.

2.7.4.5 Intermountain Power Project (IPP) North Delta Variation

This route involves a variation to the Kern River route from approximately MP 185 southeast of Nephi, Utah, to MP 327 near Avon, Utah. The variation involves doubling back from MP 185 for five miles, then turning southwest along a powerline running between the Mona substation and the IPP power plant and then intercepting the IPP corridor north of Delta, Utah. The route would then parallel IPP to reconnect with the proposed Kern River primary route at MP 327.

The route from south of Nephi to the IPP Delta-Mona powerline is rough terrain due to many small hills and valleys. Additional difficulties arise because IPP is in the process of installing a second line of metal towers. In addition the route would traverse Leamington Pass, a narrow canyon which currently contains three powerlines. This variation would require 175 miles of pipeline as opposed to 142 miles along the proposed Kern River route, or an additional 33 miles.

This routing would be very close to the IPP ground return electrode near Delta. This electrode and a similar one near Coyote Lake, California, would allow IPP to pass DC current through the Earth's surface to balance the system and to dump excess current during upset periods. This action could have a damaging effect on a pipeline through metal loss due to electrolysis. The magnitude of this effect would be proportional to the distance from the ground return electrode. Kern River is currently conducting tests in cooperation with the Los Angeles Department of Water and Power, sponsors of the IPP, to determine the potential effects of this Earth return current near the ground return electrode.

Implementation of this variation would result in approximately 33 miles of additional surface disturbance over that associated with the proposed route. Other than the additional mileage involved and traversing Leamington Pass (as opposed to Pinnacle and Scipio Pass), environmental impacts would be similar to those of the proposed route and those addressed in the Sevier-Escalante Desert Variation.

Compressor station horsepower requirements for the first two stations would remain unchanged from those required for the primary route. Compressor Station No. 5 would require 10,600 hp, an increase of 700 hp over the proposed station. Compressor Station No. 3 would be located at a point on the route of the variation which is approximately 27 miles north of its location on the primary route. The estimated cost to construct the Kern

River project utilizing this variation would be $865.3 million, a cost increase of $40.6 million or 23 percent over the costs of Kern River's proposed route. Because of the additional costs of construction, the environmental consequences of additional construction, and the fact that the variation offers no significant environmental advantage over the proposed route, this variation has been eliminated from further detailed analysis using criterion E-4.

It should be noted that subsequent to the elimination of this variation, BLM requested FERC to re-examine this variation based on a visual quality issue which Kern River's proposed route may create going through central Utah's Scipio Pass. This variation avoids Scipio Pass by crossing Leamington Pass and following the existing 500 Kv IPP powerline. Another point raised by BLM was that although this variation is longer than Kern River's proposed route, this variation would follow existing major utilities for a greater portion of its route than does the Kern River route. After further analysis, including field investigation, it was concluded that topographic features in the Scipio Pass area would limit the number of places where the pipeline route would be visible from areas along I-15, the major observation point, and that mitigation measures could be applied for far less cost than the $40.7 million that the variation would entail. The variation remains eliminated on the basis of criterion E-4 and also on the basis that well designed buried facilities with mitigation are permitted through Scipio Pass.

2.7.4.6 IPP/South Delta Variation

The South Delta Variation would establish an east and south route around Delta, Utah. The variation would diverge from North Delta Variation at a point north of Oak City, Utah, running southwest to join North Delta Variation in the Clear Lake area. The sections from Nephi to north of Oak City and from Clear Lake to Avon have been previously discussed under the North Delta Variation.

The section between Oak City and Clear Lake is relatively flat and is characterized by extensive farming to a point south of Delta, where a large marsh area exists. This variation would require construction of 160 miles of pipeline from a point southeast of Nephi at Kern River MP 185 to the point of intersection at MP 327, east of Avon, Utah. This represents 18 miles of additional construction compared to the section of the primary route it would replace.

Implementation of this variation would result in approximately 18 miles of additional surface disturbance over that associated with the proposed route. South of Delta, Utah, this variation would traverse sensitive wetland areas to the north and west of Clear Lake State Waterfowl Management Area. Environmental impacts associated with the southern portion of this variation from Clear

Lake to Avon are similar in scope to impacts associated with the portion of the primary route it replaces. Horsepower requirements remain unchanged from those on the primary route. Compressor Station No. 3 would have to be moved approximately 18 miles north of its location on the primary route. The estimated cost of construction of the Kern River project utilizing the variation would be $851.3 million. This would represent an increased cost of $26.6 million over the cost of the proposed route. The cost difference between the variation and the avoided portions of the proposed primary route represents a 13 percent cost increase. Because of the additional construction costs and the environmental consequences of additional construction, coupled with the fact that this variation does not provide a clear environmental advantage, this variation was eliminated from further detailed analysis under criterion E-4.

2.7.4.7 Sanpete Valley Variation

This variation was examined to explore the possibility of avoiding some rugged construction in the area east of Nephi, Utah. This route would diverge from the proposed route at Pines at MP 159 and would roughly parallel the Denver and Rio Grande Western Railroad south and southwest through the Sanpete and Antelope Valleys. At a point just east of Gunnison, Utah, along U.S. Highway 89, the route would bend west, crossing both the Valley and Pavant Mountains. The route would then bend northward following U.S. Highway 50 up the Scipio Valley to rejoin the primary route at approximately MP 221 just south of Scipio Pass.

The northern end of this variation, from Pines to Gunnison, Utah, crosses a higher concentration of agricultural land than does the proposed route. Reconnecting the variation to the proposed route west of Gunnison would entail difficult construction across the Pavant Mountains forcing the route to double back approximately eight miles to reconnect with the proposed alignment.

The Sanpete Valley Variation was approximately 84 miles long versus 62 miles for the proposed route. This would result in 22 additional miles of surface disturbance over the proposed route. Compressor Station No. 1 would require the same horsepower; however, Station No. 3 would require an additional 400 hp and Station No. 5 would require an additional 500 hp. The estimated cost to construct the Kern River project utilizing the Sanpete Valley Variation would be $840.7 million; a cost increase of $16.0 million over the proposed route. This would be an overall cost increase of 37 percent over the corresponding portion of the proposed route. The Sanpete Valley Variation was therefore eliminated from further detailed analysis because it did not provide a clear and significant environmental advantage over the portion of the primary route it would replace and the additional costs of construction and the environmental consequences of additional construction could not be justified. The Sanpete Valley Variation was therefore eliminated using screening criterion E-4.

2.7.5 Environmental Concerns (E-5)

The fifth screening criterion developed for alternative analysis relied solely on environmental advantages. Where there were several system or route alternatives, or variations identified to serve the same purpose, E-5 was used to determine if one of them provided such clear and significant environmental advantages that others could be dropped from further consideration. Application of E-5 resulted in the elimination of three variations.

2.7.5.1 North Las Vegas Variation with the California Spur

The California Spur of the North Las Vegas Variation would diverge from the route described in Section 2.3.4 at the upper end of Goodsprings Valley in Section 25, T23S, R58E. At this point the California Spur would follow State Route 53 west from the Goodsprings Valley and through the Spring Mountains to the Nevada/California border. Continuing along this same road, the California Spur would pass through the Mesquite Mountains, rejoining Kern River's route south of Shadow Mountain in T17N, R11E, San Bernardino County, California, at MP 552.9.

The North Las Vegas Variation utilizing the California Spur would require 122.3 miles of pipeline compared to 110.6 miles of pipeline for the North Las Vegas Variation utilizing the Goodsprings Spur. Compressor Station No. 5 would require a slight modification in horsepower and would be relocated to a point approximately two miles north of the point where the spur diverges in Section 24, T24S, R58E. The site is less than two miles from Wilson Tank in the Bird Springs Range. Wilson Tank is a major watering source for wildlife, including wild horses and burros, bighorn sheep, and chukkar partridge. The California Spur would split two wilderness study areas in California (CWSA-223 and -225) along a desert road for a distance of 13.4 miles.

On the other hand, the variation in conjunction with the Goodsprings Spur would be 11.7 miles shorter thus causing less surface disturbance. The Goodsprings Spur would cross one prime desert tortoise habitat for a distance of 7.9 miles. The compressor station that would be located on the route of this variation would impact known high density populations of the desert tortoise. The area is also frequented by desert bighorn sheep and chukkar partridge.

Use of either spur with the North Las Vegas Variation would potentially impact the respective areas. From a surface disturbance standpoint, impact would have been greater along the California Spur because of its additional 11.7-mile length. More significant, however, was information from the BLM which indicated that unless pipeline construction activities would be confined to the road ROW in California (a width of 12 to 15 feet), this route would be unacceptable because permanent disturbances in the wilderness study areas immediately adjacent to both sides of the road were prohibited. Given this drawback, it was clear that the California Spur did not provide significant environmental advantage over either the portion of the proposed route that it would have replaced or use of the Goodsprings Spur. The California Spur was therefore eliminated from further analysis under screening criterion E-5.

2.7.5.2 Sunrise Mountain Variations

Three routes were identified which would have replaced a one-mile portion of its proposed route immediately north of the Rainbow Gardens and east of Las Vegas. This portion of the proposed route would cross the Sunrise Mountain Natural Area which is administered by the BLM. Until Congress acts on BLM recommendations regarding environmental characteristics of the natural area, no ROW grants to cross it may be issued by the BLM. Accordingly, Kern River identified two route variations which would have avoided the natural area and a third variation which would cross the area by paralleling an existing powerline ROW. None of the Sunrise Mountain Variations would have affected compression requirements or siting.

Sunrise Mountain Corridor Variation

The Sunrise Mountain Corridor Variation would begin 10.5 miles northeast of Henderson, Nevada, in T20S, R63E, where Kern River's proposed route leaves the IPP and Navajo-McCullough powerline ROW at MP 483.4. From this point, this variation paralleled the powerlines for an additional 3.4 miles, crossing the Sunrise Mountain Natural Area. The variation then left the powerline ROW and turned to a more westerly heading, crossing hogback ridges at natural washes or gaps. The variation would have rejoined the proposed route at MP 490.4. The variation totaled 7.2 miles in length and would have added 0.2 mile to the proposed route.

The advantage this variation had over Kern River's proposed route is that the variation followed an established utility ROW for about half of its length. The portion of the proposed route which this is comparable to follows no existing ROWs. However, because the variation would not have resolved the underlying problem which the Sunrise Mountain Variations were intended to circumvent (i.e., construction across the Sunrise Mountain Natural Area) and another route (the North Las Vegas Variation) is available, the variation was eliminated from further analysis under criterion E-5.

Sunrise Mountain-Lake Mead Variation

The Sunrise Mountain-Lake Mead Variation would have begun 11.5 miles northeast of Henderson, Nevada, in T20S, R63E, at MP 482.3. This variation would have left the powerline ROW, headed due south, and crossed gypsum mining operations and the Gypsum Wash. In the vicinity of Gypsum Wash, the variation would have turned westward to parallel the southern boundary of the Sunrise Mountain Natural Area property. This westward leg would have crossed about 2.2 miles of the Lake Mead National Recreational Area (NRA), which abutts the natural area between the Gypsum Wash and a point just east of the powerline ROW. The variation would then have joined the Sunrise Mountain Corridor Variation just one mile downstream from that variation's exit from the natural area. From this point it would have followed the Sunrise Mountain Corridor Variation to its terminus at MP 490.4 on the proposed route. The variation totaled 10.3 miles and, if adopted, would have added 2.2 miles to the proposed route.

In avoiding the Sunrise Mountain Natural Area, this variation would have intruded on the Lake Mead NRA. Contacts with the National Park Service which administers the NRA indicated that since the variation would not use one of the three transmission corridors which cross the NRA and that the Park Service would therefore deny any request for pipeline construction in the area of this variation. [10] On this basis, the variation was eliminated under criterion E-5.

Sunrise Mountain-Rainbow Gardens Variation

The Sunrise Mountain-Rainbow Gardens Variation was identical to the Sunrise Mountain-Lake Mead Variation until just south of the Gypsum Wash crossing. Once across the wash, the variation would have proceeded in a southwesterly direction to a point immediately north of the Las Vegas Wash in Section 28, T21S, R63E. As with the Sunrise Mountain-Lake Mead Variation, this route variation would have avoided the natural area at the expense of crossing about 3.5 miles of the NRA. From Section 28, the variation would have turned north-northwest and proceeded to its terminus (still on the north side of the Las Vegas Wash) at MP 493.9 on the proposed route. This variation totaled 15.2 miles and would have added 3.6 miles to the proposed route. Because the variation would have crossed the Lake Mead NRA in the same area as the Sunrise Mountain-Lake Mead Variation, the varia-tion was eliminated from further analysis under criterion E-5.

---

[10] Gary E. Bunney, Acting Superintendent, Lake Mead NRA, letter to FERC staff dated August 15, 1986.

2.7.5.3 Tejon Canyon Variation

The Tejon Canyon Variation represents Kern River's route through the Tehachapi Mountains as originally filed in Kern River's certificate of application. Further study of the area showed that a better route exists. This new route was adopted as the proposed route with the original route retained as the Tejon Canyon Variation.

This variation would leave the primary route at MP 718 and proceed in a southwesterly direction up Oak Creek Canyon to its intersection with Horse Thief Canyon, and then west up that canyon. The variation would then pass up and over a high saddle before entering Tejon Canyon and would proceed west down the canyon to its mouth. The variation would then proceed in a northwesterly direction to the intersection with the prime route at MP 740. The variation would total 20.3 miles as compared to 22.0 miles for the corresponding segment of the primary route.

From Oak Creek Canyon to Horse Thief Canyon (two miles) the terrain is severe. Horse Thief Canyon is very narrow with steep walls and the probability of blasting this portion of the route would be very high. The terrain of the first mile of Tejon Canyon is similar to Horse Thief Canyon. The next four miles of the canyon start to open into areas of grasslands, but the remaining eight miles may require blasting. Meandering creeks in the canyons would have to be crossed many times and there is a possibility that some of the natural springs in the canyons would be altered. Both Horse Thief and Tejon Canyons appear vulnerable to high runoff during the spring; accordingly, erosion would be a prime concern. In the mountainous areas, raptors (hawks, eagles, etc.) rest in the tall trees. An inventory of nesting sites might be necessary.

This variation would require 1.7 miles less pipeline than the proposed route and would not affect compression requirements. It would result in a total project cost of $823.1 million. Although this variation would result in reduced costs of $1.56 million, the potential for periodic pipeline washouts resulting from erosion and soil instability and the inaccessibility of the route indicate that the alignment of the proposed route is both environmentally and economically superior to the variation in the long term.

The Tejon Canyon Variation was eliminated from further analysis using screening criterion E-5 because it does not provide clear and significant environmental advantages over the proposed route.

2.7.6 Environmental Comparison of Alternatives (E-6)

The preceding five screening criteria have all been concerned with comparing alternative routes and variations against the primary route. Following these screening processes, 14 alternatives and variations to the Kern River proposal remained. The next phase of screening expanded the perspective of the analysis maintained during the previous phase and compared the remaining alternatives and variations with one another (rather than individually to Kern River's proposed project), as well as with the competing projects themselves on the basis of qualitative environmental differences. This resulted in the following two system alternatives being eliminated from further analysis.

2.7.6.1 Southern Systems A Alternatives

These three alternatives would have substituted a combination of existing pipeline systems and system upgrades for all of the Kern River system. As with the Southern Systems Alternative B presented in Section 2.6.2.4, the full 700 MMcfd of natural gas proposed to be shipped to southern California would be transported to the southernmost point on Northwest's system at Ignacio, Colorado. Here the gas would be delivered to mainline transmission facilities owned by El Paso Natural Gas Company through an existing interconnection for transportation to the Arizona/California border. At the border, the A Alternatives would have transferred the 700 MMcfd to an integrated PG&E/SoCal system for delivery to the Bakersfield area (unlike the B Alternative which involved a Kern River system between the border and Bakersfield). Alternative A-1 would have involved Northwest, El Paso, and PG&E/SoCal. Alternatives A-2 and A-3 would have involved Transwestern as well.

Alternative A-1

The distinctive feature of this alternative was that it required El Paso to deliver 700 MMcfd to an integrated PG&E/SoCal system at the Arizona/California border. The extensive facility requirements needed by El Paso and Northwest were detailed in Section 2.6.2.4. Beyond these, the FERC staff assumed that a 17-mile interconnecting lateral (similar to the proposed Mojave Transfer Line described in Section 2.2 of Volume I) and a new 17,000 hp compressor station on the PG&E system near Danby, would be necessary to facilitate operation of the PG&E and SoCal systems in a fully integrated fashion.

Near Douglas Pass in Colorado it is likely that slope instability would require Northwest to deviate from its present alignment. Also, looping through Arches National Park near Moab, Utah, would be prohibited. Construction around the park boundary would have involved an additional 25 miles of surface disturbance. Significant pipeline construction problems would be encountered in attempting to loop Northwest's mainline through the already congested Moab Canyon. The area around Durango, Colorado, has some land development of high value which could cause high acquisition costs and potential condemnation expenses.

Environmental considerations along the Northwest portion of the alternative route are primarily archaeological, wildlife, and water quality concerns. The area of southern Colorado affected by the alternative is rich in cultural and historical significance. This area has yielded significant cultural resources including tools, pottery, and architectural features (cliff dwellings, surface pueblos, and pithouses) dating back to the Anasazi Indians and has the potential to yield additional resources in these categories. Significant cultural resources could be impacted by this alternative.

The American bald eagle and the American peregrine falcon are threatened and endangered species that winter in the area. Potential black-footed ferret habitat exists in the vicinity of the looping in southwestern Wyoming that this alternative would require. The Green River crossing below Flaming Gorge Dam is within a designated high quality fishing area (Class I) and is also a launch site for commercial raft trips during the summer months. The endangered Colorado River squawfish, the humpback chub, and bonytail chub have been reported in the Green River below Vernal, Utah, and in the Colorado River. Threatened and endangered plant species that have been identified in the area include the Uintah Basin hookless cactus and the spineless hedgehog cactus.

In addition to these concerns the pipeline route would parallel Douglas Creek for extended distances which could easily affect water quality. The alternative would also pass through about 23 miles in Flaming Gorge NRA (where the Forest Service has indicated that ROW expansion would be prohibited), and portions of both the Ashley and San Juan National Forest. Neither forest has a designated utility corridor along the existing Northwest ROW. Northwest's system also passes near Dinosaur National Monument and Mesa Verde National Park, where looping associated with this alternative would have been required.

Environmental considerations along the El Paso portion of the alternative route were primarily archaeological, paleontological, wildlife, and vegetative concerns. The area of the San Juan Basin in northwestern New Mexico affected by the expansion project is rich in cultural and historical significance. The potential for recovering archaeological remains associated with the Chacoan Culture is good. In addition, a substantial amount of archaeological remains have been found between Gallup and the Williams Loop of the El Paso Expansion Proposal. Paleontological resources could also be adversely affected by the expansion project. These resources would be encountered in the San Juan Basin in northwestern New Mexico. Additional paleontological resources would be encountered in northeastern Arizona.

The American bald eagle and the American peregrine falcon are threatened and endangered species that winter in the area. Potential black-footed ferret habitat exists in the vicinity of looping in the San Juan Basin that this alternative would require. Candidate species for listing as threatened and endangered by the USFWS include the ferruginous hawk, Swainson's hawk, mountain plover, Gila monster, and the desert tortoise. Federally listed endangered and threatened plant species which could be found within the analysis corridor include Knowlton cactus, Mancos milkvetch, Mesa Verde cactus, Peebles Navajo cactus, and the Arizona cliffrose.

Aside from the interconnecting lateral and a new 17,000-hp compressor station on PG&E's system near Danby, integrated operation of the PG&E/SoCal systems would provide sufficient capacity to transport the 700 MMcfd from the Arizona/California border to the Bakersfield area by using existing pipeline facilities. As discussed in Section 4.4 of Volume I, environmental considerations associated with the Danby Compressor Station included soil erosion, vegetation, and wildlife concerns. Primary considerations along the interconnecting lateral included wind-borne soil erosion, and were discussed as part of the Mojave proposal in Section 4.2 of Volume I.

Overall, the Southern System Alternative A-1 would have ground disturbing activities on 912.8 miles covering six states. The total costs of the project would be $714.2 million. This alternative can be compared with a number of the other alternatives mentioned above. When compared to Kern River's primary route, this alternative would be approximately 76 miles longer, thus having the potential for having greater environmental disturbance. Cost differences between the Kern River primary route and this alternative would be $110.5 million, with the alternative less costly.

Other alternatives which were compared to Alternative A-1 included the East Las Vegas Alternative (Section 2.4.3) and the East Las Vegas Alternative with the Wasatch Variation (Section 2.4.4). The East Las Vegas Alternative in conjunction with the Kern River project would be approximately 612 miles long. This route would be approximately 301 miles shorter than Alternative A-1 and thus environmental impacts due to ground disturbing activities would be less. Cost of the East Las Vegas Alternative would be approximately $637.1 million, $156.4 million less than Alternative A-1.

In terms of mileage, cost, and affected areas, the East Las Vegas Alternative with the Wasatch Variation is roughly equivalent to the Kern River Project in conjunction with the East Las Vegas Alternative discussed above. The East Las Vegas with the Wasatch Variation (Section 2.4.4) would be 634 miles long versus the 912.8 miles for Alternative A-1. The Southern Systems Alternative would result in 278.8 miles more surface disturbance. Cost differences between the two were estimated to be $77 million, with Alternative A-1 being more costly.

Other arrangements which could meet the goals of the project with regard to delivering natural gas to the EOR/cogeneration market in the Bakersfield area would include (a) the Mojave Pipeline Proposal, (b) the El Dorado Pipeline Proposal (both of which would be coupled with the El Paso and/or Transwestern Expansion Projects, all of which is the subject of Volume I), and (c) gas supplied by the California Intrastate Systems (see Section 2.4.5).

The preceding discussion indicates that there are a number of routes and alternatives under consideration which could meet the goals of the project with less environmental impact or impacts equal to Alternative A-1. Screening criterion E-6 therefore is essentially similar to the E-5 criterion discussed in Section 2.6.5. The Northwest pipeline looping of 439 miles represents the major area of environmental concern. These concerns involve archaeological, wildlife, and water quality coupled with the fact that the pipeline route would run through or close to a number of national parks and forests, recreation areas, and monuments. These impacts, particularly concerning recreational facilities, would have an effect on a national scale. When coupled with the increased mileage for the El Paso Expansion Project, these factors made the Southern Systems Alternative A-1 environmentally less attractive than either the proposed routes of Kern River, Mojave or the other alternatives discussed above. As a result, the Southern Systems Alternative A-1 was eliminated from further analysis.

Alternative A-2

The distinctive feature of this alternative was that it required Transwestern to deliver 700 MMcfd to an integrated PG&E/SoCal system at the Arizona/California border. In virtually all other respects, Alternative A-2 is identical to Alternative A-1.

New facilities required on Northwest's system to implement Alternative A-2 were the same as those required by Alternative A-1. The environmental concerns previously discussed with regard to the Northwest expansion would still apply in this alternative.

New facilities required on El Paso's system to implement Alternative A-1 would have been scaled back for Alternative A-2. All facilities outlined to the east of El Paso's Window Rock, (Arizona) Compressor Station were necessary for Alternative A-2, i.e., 145 miles of 34-inch line from Ignacio to Window Rock. Again, environmental concerns discussed for El Paso would apply.

The Transwestern proposal for Alternative A-2 would begin at the Window Rock Compressor Station and would entail approximately 229 miles of 36-inch looping and the addition of 79,475 hp of compression according to the FERC staff's estimates. Environmental impacts along the Transwestern pipeline looping project through Arizona would be roughly equivalent to those discussed for El Paso under Alternative A-1. The full 700 MMcfd would then be transferred to an integrated PG&E/SoCal system at the

California border. The integrated PG&E/SoCal system could then deliver the 700 MMcfd to the EOR/cogeneration market in the Bakersfield area without new facilities, according to the respective companies. The FERC staff, however, believes that 17 miles of 24-inch line would be required in order to fully integrate the two intrastate companies.

From a purely environmental standpoint Alternative A-2 would be equivalent to Alternative A-1. Based on mileage figures and the effects of ground disturbance, Alternative A-2 would impact 875 miles with an additional 79,500 hp versus the 913 miles on Alternative A-1. Given the same group of proposals and alternatives cited in the discussion of Alternative A-1 for comparison, Alternative A-2 was eliminated from further consideration under screening criterion E-6.

Alternative A-3

This alternative would represent a combination of Alternatives A-1 and A-2 with the 700 MMcfd distributed between El Paso and Transwestern. Both companies would deliver gas to PG&E/SoCal at the Arizona/California border. The alternative would again require 439 miles of 36-inch loop, 62 miles of 30-inch laterals, and 24,925-hp of additional compression on the Northwest system. (See Section 2.6.2.4 for details.) It would also entail 216 miles of 30-inch loop along the El Paso line from Ignacio, Colorado, to Topock, Arizona. The FERC staff estimates that 199 miles of 30-inch loop on the Transwestern line between Window Rock, Arizona, and Transwestern's Needles metering station at the Arizona/California border. No additional facilities would be needed by the integrated PG&E/SoCal system according to the respective companies. The FERC staff, however, believes that 17 miles of 24-inch line and 17,000 hp of new compression would be required in order to fully integrate the two intrastate companies and ensure sufficient spare capacity.

A general list of environmental concerns with regard to this alternative include archaeological, wildlife, water quality, and recreational concerns. A more detailed discussion of the potential environmental impacts are discussed with Alternative A-1. From a purely surface disturbance perspective, Alternative A-3 would impact approximately 916 miles. This compares to the 837 miles of the Kern River proposed route it would replace and lesser mileages for Kern River using the East Las Vegas Alternative. Since Alternative A-3 has environmental impacts equal to or greater than those of Alternatives A-1 and A-2, it has been eliminated from further detailed analysis using screening criterion E-6. A detailed review of the reasons for deletion has been presented in the discussion of Alternative A-1 above.

2.7.6.2 North-South Systems Alternatives

These three alternatives would substitute a combination of existing pipeline systems and system upgrades for the entire Kern River system. The 350 MMcfd of Canadian gas would be delivered to PGT via Northwest's existing interconnection at Stanfield, Oregon, for redelivery to PG&E and subsequent transport to the Bakersfield area. Only the Canadian portion of the gas would be shipped by this northern route. The 350 MMcfd of Overthrust Belt gas would be delivered to El Paso at Northwest's Ignacio interconnection. The gas would then be transported to Topock by one of three alternatives for redelivery to PG&E/SoCal, who would ship the gas to the Bakersfield area. Alternative A would have involved El Paso alone; Alternatives B and C would have involved Transwestern as well.

Alternative A

The distinctive feature of this alternative was that El Paso would have transported the full 350 MMcfd from Ignacio to Topock, Arizona. To deliver the required volumes to El Paso at Ignacio and to PGT at the Stanfield interconnection, Northwest would be required to add approximately 46 miles of 26-inch and 393 miles of 24-inch mainline looping and to upgrade numerous compressor stations. In addition, Northwest would build the 62 miles of 30-inch lateral previously described to collect and transport Overthrust Belt gas from southwestern Wyoming into Northwest's mainline.

In designing its facilities, Northwest assumed that the gas delivered to PGT would be Canadian gas transported by Northwest from Sumas, Washington, to Stanfield, Oregon, while the gas delivered to El Paso would be domestic gas from the Overthrust Belt transported by Northwest to Ignacio, Colorado. The looping of the existing pipeline with 26-inch pipe would be from the Muddy Creek Station to the Green River Station. From the Green River Station to the Ignacio Station, the looping would be with 24-inch pipe and would parallel the existing pipeline.

Five existing compressor stations would require additional equipment and upgrading to implement this alternative and three new compressor stations would have to be installed. The new stations would be required at MP 68 (Cahone), MP 196 (Cisco), and Stanfield, Oregon. In addition, compression would be added to the Ignacio Station.

Environmental considerations along this portion of the Northwest system would be similar to those discussed in the Section 2.6.6.1. The primary environmental considerations along the native with regard to Northwest are archaeological, wildlife, water quality, and recreational resources.

The El Paso system would deliver 350 MMcfd from Ignacio, Colorado, to Topock, Arizona, along the route outlined in Volume I, Section 2.8. In order to deliver the 350 MMcfd, 18.2 miles of 30-inch loop on the San Juan High Pressure System, 38.2 miles of 34-inch loop on the San Juan Low Pressure System, and 35.6 miles of 30-inch loop on the San Juan Low Pressure System would be necessary. A new compressor station would also need to be constructed at Bondad with two turbines rated at 5,300 hp (ISO) each.

The 30-inch looping project on the San Juan High Pressure System would occur between MP 0.0 (Ignacio) to MP 3.6 (Bondad); MP 19.5 to MP 34.1 (Blanco). The 34-inch looping project on the San Juan Low Pressure System would occur at MP 4.7 to MP 21.5; MP 43.6 to MP 51.1; and MP 65 (Gallup A) to MP 78.9. The 30-inch looping project on the San Juan Low Pressure System would occur between MP 97.0 to MP 102.5 (Window Rock A); MP 102.5 to MP 109.0; MP 159.5 to MP 165.5; MP 266.6 to MP 275.9 (Williams A); and MP 367.0 to MP 375.0 (Hackberry A).

Environmental considerations along the El Paso portion of the alternative route are primary archaeological, paleontological, wildlife, and vegetative concerns. A detailed discussion of the environmental concerns related to the El Paso system has been presented in Section 2.6.6.1.

No expansion of either the PGT or PG&E system would be required to serve 350 MMcfd through the 1992-93 winter season.

Both PG&E and SoCal indicated that the 350 MMcfd of gas delivered to them by El Paso at Topock could be transported to the Bakersfield area utilizing existing facilities. However, in order to enable the two intrastate companies to be fully integrated, the FERC staff believes that 17 miles of 24-inch interconnecting line would have to be constructed near the Arizona/California border.

Environmental concerns along the PGT and PG&E systems in Oregon and California would be similar to those discussed under the Northern System Alternative A (see Section 2.6.3.2).

Alternative B

Alternative B would be similar to A with one exception. Instead of El Paso delivering the 350 MMcfd at Topock to the California intrastate and the SoCal systems, the gas would be delivered to Transwestern at Window Rock. Transwestern would then deliver the 350 MMcfd to SoCal at the Needles, California, metering station. Under this alternative the Northwest, PGT, PG&E, and SoCal systems would remain unchanged from Alternative A.

The El Paso system would involve approximately 61.9 miles of 30- and 34-inch loop to the Window Rock compressor station. An additional 10,600 hp of compression would also be needed at the Bondad station. The Transwestern system would require 198.8 miles of 30-inch loop between Window Rock and the Needles metering station, according to FERC staff estimates.

Alternative C

Alternative C would be similar to B with one exception. Instead of delivering 350 MMcfd to Transwestern at Window Rock, El Paso would only deliver 240 MMcfd to Transwestern and then El Paso would transport 110 MMcfd to SoCal at the Needles metering station. Under this alternative the Northwest, El Paso, PGT, PG&E, and SoCal systems would remain unchanged from Alternative B.

The Transwestern system would require 133 miles of 30-inch loop between Window Rock and the Needles metering station, according to FERC staff estimates.

Environmental concerns along the southern portion of Alternatives B and C would be similar to those discussed for the Southern Systems Alternative 3 in Section 2.6.6.1. Since the El Paso and Transwestern systems across Arizona are roughly parallel, environmental concerns discussed for El Paso would be appropriate for the Transwestern system.

All three alternatives would have required identical facility additions on Northwest's system. Environmental concerns associated with these facilities were discussed in Section 2.6.6.1 for the Southern System Alternatives. The North-South System Alternatives focused on archaeological, paleontological, wildlife, water quality, and recreational concerns similar to those outlined in Section 2.6.6.1.

Of the three alternatives, Alternative B was clearly the less desirable because it would have involved ground disturbance along 261 miles of pipeline ROW on the El Paso and Transwestern systems compared with 194 miles associated with Alternative C and only 92 miles associated with Alternative A. Because the three alternatives would have served an identical purpose and Alternative A resulted in significantly less ground disturbance, Alternatives B and C were eliminated from further consideration under screening criterion E-5.

Alternative A was eliminated under criterion E-6 for the same reasons cited to eliminate the Southern Systems Alternatives. As with those, a major disadvantage to Alternative A was the looping which would have been required along Northwest's system between the Opal area and Ignacio. For the reasons discussed in Section 2.6.6.1, this looping would have resulted in significant and potentially serious environmental consequences. While impact anticipated to result from the El Paso looping between Ignacio and western Arizona would be limited, it would nonetheless incrementally increase the overall impact associated with this alternative.

A final factor on which the decision to eliminate Alternative A from further consideration was the pool of other routes to which it was compared, i.e., the East Las Vegas Alternative, the East Las Vegas Alternative coupled with the Wasatch Variation, and the routes proposed by Kern River, Mojave, and El Dorado. Use of one of these routes could meet the goals of the project with impact less than or equal to that associated with the North-South Systems Alternative A. Alternative A was therefore eliminated under criterion E-6.

2.8 INTERRELATIONSHIP WITH OTHER PLANNED OR PROPOSED PROJECTS

Projects that are in the planning stages in the relevant portions of the various project proposal have been examined to determine which ones are likely to be in the construction phase during 1987 and 1988. Other planned projects that have the potential to result in incremental additive and/or additive effects on the pipeline have been considered, as appropriate, in the cumulative impact analysis. The criteria for consideration of other planned projects are as follows:

- planned project would be constructed during 1987 and 1988,
- planned project is clearly in the development stage,
- planned project would result in impacts to the same geographic area of influence as the proposed projects, including alternatives.

The projects to be considered for cumulative impacts include the Celeron/All American Pipeline Project, Mead/McCullough-Victorville/Adelanto Transmission Project, Intermountain Power Project, Central Utah Project, Mountain Fuel Central/Southern Utah Project, Mountain Fuel Bountiful Pipeline, Bountiful City Municipal Water Project, Bountiful City Transmission Line Project, Utah Power and Light Company/Utah Associated Municipal Power Systems Southern Utah Transmission Projects.

3.0 AFFECTED ENVIRONMENT

3.1 KERN RIVER PROPOSAL

3.1.1 Air Quality

Table 3.1-1 summarizes the federal primary and secondary standards as well as the state standards for pollutants of interest to the proposed projects.

For a general discussion of the Clean Air Act, PSD Review, and the New Source Review regulations, see Section 3.1 of Volume I.

The existing air quality conditions along the route proposed for the pipeline are described below. Due to the vast distances covered by the proposed project and the sparseness of available data, data from monitoring stations closest to the pipeline route are used. Characterization of existing air quality is based on the pollutant concentrations measured from 1982 through 1984. Tables 3.1-2 through 3.1-4 list the measurements of relevant pollutants for Nevada (Table 3.1-2), Utah (Table 3.1-3), and Wyoming (Table 3.1-4). Tables 3.1-3 and 3.1-4 in Volume I show pollutant measurements for Kern County and the Southeast Desert Air Basin.

PSD Class I areas include the Zion National Park in southwestern Utah, about 60 miles east of the proposed pipeline, the High Uintas Wilderness, Mount Timpanogos Wilderness, and Mount Nebo Wilderness, all from 10 to 30 miles from the proposed pipeline.

Ozone measurements at the Bountiful and Cottonwood stations near Salt Lake City, Utah, exceed the federal one-hour standard; however, these stations are not representative of the rural areas through which the proposed pipeline will pass. The urban influences also reflect in the CO measurements at Cottonwood. At the present time, Utah County is designated as nonattainment for TSP; the TSP measurements at Pleasant Grove have exceeded the federal 24-hour and annual secondary standards in recent years. The only available station in southwest Utah is Cedar City. TSP measurements at this station are below the federal 24-hour and annual standards.

Clark County, Nevada, is currently designated as nonattainment for ozone, TSP, and CO. Ozone measurements at Henderson and in Las Vegas equal or exceed the federal one-hour standard. The Las Vegas measurements also show exceedances of the federal TSP (both 24-hour and annual) and CO (8-hour) standards. Since CO is emitted primarily by urban traffic, the CO measurements in Las Vegas may not be representative of rural areas along the proposed pipeline route.

Table 3.1-1

SUMMARY OF AMBIENT AIR QUALITY STANDARDS

Pollutant	Average Time	Federal Standards 1/		Utah	Wyoming	Nevada	California
		Primary	Secondary				
Ozone	1 hour 2/	235 ug/m^3 (.12 ppm)	235 ug/m^3	235 ug/m^3	.08 ppm	235 ug/m^3	.10 ppm
Carbon Monoxide	1 hour 3/	40 mg/m^3 (35 ppm)	40 mg/m^3	40 mg/m^3	40 mg/m^3	40 mg/m^3	20 ppm
	8 hour 3/	10 mg/m^3 (9 ppm)	10 mg/m^3	10 mg/m^3	10 mg/m^3	10 mg/m^3	10 mg/m^3
Nitrogen Dioxide	1 hour	-	-	-	-	-	.25 ppm
	Annual	100 ug/m^3	100 ug/m^3	100 ug/m^3	100 ug/m^3	100 ug/m^3	-
Sulfur Dioxide	1 hour	-	-	-	-	-	.25 ppm
	3 hour 3/	-	1300 ug/m^3 (.50 ppm)	1300 ug/m^3	-	-	-
	24 hour 3/	365 ug/m^3 (.14 ppm)	-	365 ug/m^3	.10 ppm	365 ug/m^3	.05 ppm
	Annual	80 ug/m^3 (.03 ppm)	-	80 ug/m^3	.02 ppm	80 ug/m^3	-
Particulates (TSP)	24 hour 3/	260 ug/m^3	150 ug/m^3	260 ug/m^3	150 ug/m^3	-	50 ug/m^3
	Annual (Geo. Mean)	75 ug/m^3	60 ug/m^3	75 ug/m^3	60 ug/m^3	-	30 ug/m^3
Lead	30 day	-	-	-	-	-	1.5 ug/m^3
	24 hour	-	-	-	-	1.5 ug/m^3	-
	Quarter year	1.5 ug/m^3	1.5 ug/m^3	1.5 ug/m^3	-	-	-

1/ in micrograms per cubic meter (ug/m^3) and parts per million (ppm)
2/ not to be exceeded more than one day per year, based on a three-year running average
3/ not to be exceeded more than once per year
not available

Table 3.1-2

SUMMARY OF RELEVANT AIR QUALITY DATA IN NEVADA

		O_3 (ppm)	NO_2 (ug/m^3)		SO_2 (ug/m^3)				TSP (ug/m^3)		CO (mg/m^3)	
Station	Year	Maximum 1-Hr	Max 1-Hr	Annual Mean	Max 1-Hr	Max 3-Hr	Max 24-Hr	Annual Mean	Max 24-Hr	Annual Mean	Max 1-Hr	Max 8-Hr
Las Vegas	1982	0.11	-	40	-	-	-	-	-	-	26	22
	1983	0.14	-	45	-	-	-	-	1019	90	29	19
	1984	0.12	-	58	-	-	-	-	310	101	24	19
Henderson	1982	0.14	-	-	-	-	-	-	-	-	-	-
	1983	0.12	-	-	-	-	-	-	-	-	-	-
	1984	0.12	-	-	-	-	-	-	-	-	-	-
Moapa Generating Station	1982	-	-	-	-	35	11	-	-	-	-	-
	1983	-	-	-	-	33	7	-	-	-	-	-
	1984	-	-	-	-	86	66	-	-	-	-	-
So Cal Edison Mohave	1982	-	-	-	-	39	16	-	-	-	-	-
	1983	-	-	-	-	59	17	-	-	-	-	-
	1984	-	-	-	-	33	13	-	-	-	-	-

Table 3.1-3

SUMMARY OF RELEVANT AIR QUALITY DATA IN UTAH

		O_3 (ppm)	NO_2 (ug/m^3)		SO_2 (ug/m^3)				TSP (ug/m^3)		CO (mg/m^3)	
Station	Year	Maximum 1-Hr	Max 1-Hr	Annual Mean	Max 1-Hr	Max 3-Hr	Max 24-Hr	Annual Mean	Max 24-Hr	Annual Mean	Max 1-Hr	Max 8-Hr
Bountiful	1982	0.15	338	38	–	419	157	26	191	39	17	7
	1983	0.15	–	–	–	262	105	26	206	43	17	9
	1984	0.17	–	–	–	314	183	26	173	53	15	7
Cedar City	1982	–	–	–	–	–	–	–	103	39	–	–
	1983	–	–	–	–	–	–	–	83	38	–	–
	1984	–	–	–	–	–	–	–	211	52	–	–
Cottonwood	1982	0.14	–	–	–	–	–	–	281	51	17	10
	1983	0.15	–	–	–	–	–	–	155	51	21	12
	1984	0.14	–	–	–	–	–	–	266	64	21	14
N Salt Lake	1982	–	–	–	–	550	183	26	269	68	–	–
	1983	–	–	–	–	105	52	26	–	–	–	–
	1984	–	–	–	–	367	157	26	242	100	–	–
Pleasant Grove	1982	–	–	–	–	–	–	–	266	44	–	–
	1983	–	–	–	–	–	–	–	113	41	–	–
	1984	–	–	–	–	–	–	–	480	68	–	–
University Ave, Provo	1982	–	–	–	–	–	–	–	–	–	31	22
	1983	–	–	–	–	–	–	–	–	–	38	25
	1984	–	–	–	–	–	–	–	–	–	25	17

Table 3.1-4

SUMMARY OF RELEVANT AIR QUALITY DATA IN WYOMING

Station	Year	Max 24-Hr	TSP (ug/m^3) Annual Mean
Evanston	1982	166	53
	1983	353	58
	1984	117	40
Kemmerer	1982	99	37
	1983	112	39
	1984	90	39
Granger	1982	188	37
	1983	116	29
	1984	75	29

Air quality measurements are not available to characterize the portion of the Kern River route extending from the Nevada-California border to Barstow. This portion is within San Bernardino of the Southeast Desert Air Basin. San Bernardino is in nonattainment for ozone and TSP.

3.1.2 Geology

The Kern River route transects six major physiographic provinces: Wyoming Basin, Middle Rocky Mountains, Basin and Range, Mojave Desert, Tehachapi Mountains, and San Joaquin Valley. These provinces do not correlate perfectly with geographic regions used in other disciplines in this document.

The geology, physiography, seismicity, stability, and mineral resources all vary significantly from one physiographic region to another. Therefore, the geologic description of the pipeline has been broken down into a discussion of the pipeline route within each major physiographic division or other geographical point of separation. Table 3.1-5 summarizes the geologic and physiographic characteristics of the project area.

3.1.2.1 Wyoming Basin (MP 0-70)

Geology and Physiography. The pipeline route begins at the Muddy Creek Station in the Bridger Basin, a subdivision of the Wyoming Basin, and traverses southwest to the Utah border. The Wyoming Basin is an extension of Great Plains topography into the Middle Rocky Mountains Province.

Landforms in the Bridger Basin consist of resistant sandstone and limestone bedrock layers which have been folded and eroded to

Table 3.1-5

GEOLOGIC AND PHYSIOGRAPHIC CONDITIONS, KERN RIVER PROPOSAL

Location	Geol/Phys Province	Geologic Unit	Age	Topography	Comments
(MP 0-70)	Wyoming Basin	Sedimentary rocks, alluvium	Eocene	Low relief, locally steep banks	Saturated valley floors
(MP 70-185)	Middle Rocky Mtns	Sedimentary and igneous rocks, alluvium	Pennsylvanian to Tertiary; recent	Very high relief very steep slopes rugged	Large landslides, faults, avalanches
(MP 185-402)	Basin & Range	Sedimentary and volcanic rocks; lacustrine sediments, alluvium	Precambrian to Tertiary; recent	Low to moderate relief, local steep slopes	Saturated valley floors; faults
Virgin River Valley (MP 406-445)	Basin & Range	Alluvium, sedimentary rocks	Quaternary and Tertiary, Triassic and Permian	Low to moderate relief	Sand deposits and tuffaceous sedimentary rocks, along with locally occurring limestone
Dry Lake Valley (MP 450-480)	Basin & Range	Alluvium, sedimentary rocks	Quaternary, Permian, Tertiary-Cretaceous-Cambrian	Low to moderate relief, gentle slopes	Unconsolidated fan and floodplain deposits. Thick massive units of limestone
Mountains east of Las Vegas (MP 490)	Basin & Range	Sedimentary rocks	Triassic, Tertiary	Moderate relief, some steep slopes	Tuffaceous deposits along with massive deposits of siltstone, limestone and sparse conglomerate
East Las Vegas throughout the Ivanpah Valley south of the Spring Mtns (MP 495-535)	Basin & Range	Alluvium, igneous and sedimentary rocks	Quaternary, Tertiary	low to moderate relief, gentle slopes to moderately steep slopes	Sand deposits, basalt and andesite flows, limestones

Table 3.1-5 (continued)

GEOLOGIC AND PHYSIOGRAPHIC CONDITIONS, KERN RIVER PROPOSAL

Location	Geol/Phys Province	Geologic Unit	Age	Topography	Comments
Clark Mountains (MP 535-548)	Mojave Desert	Alluvium, sedimentary rocks	Quaternary, Cretaceous, Cambrian, Precambrian, Devonian	High relief, steep slopes with low relief on Alluvial fans	Unconsolidated to poorly consolidated sands and gravels. Sedimentary rocks mostly sandstones & limestones
Shadow Valley (MP 550-560)	Mojave Desert	Alluvium	Quaternary	Low relief, gentle to flat slopes	Unconsolidated to poorly consolidated sands and gravels
Shadow Mountains (MP 560-575)	Mojave Desert	Igneous and sedimentary rocks; lake deposits	Mesozoic, Cambrian, Tertiary	Moderate relief, moderate to steep slopes	hard to very hard igneous rocks; limestones; lake deposits
Silurian Valley (MP 575-585)	Mojave Desert	Alluvium, playa lake deposits, sedimentary rocks	Quaternary Cambrian	Low to moderate relief, moderate slopes flat in areas	Unconsolidated to poorly consolidated playa deposits. Well consolidated limestones and shales
North end of Soda Mountains (MP 585-595)	Mojave Desert	Igneous rocks & alluvium	Mesozoic, Quaternary	Low to moderate relief, low to steep slopes	Volcanic rocks and unconsolidated to poorly consolidated gravel and sand deposits, hard granites
North of the Calico Mountains (MP 600-630)	Mojave Desert	Alluvium, sedimentary rocks	Quaternary & Tertiary	Low relief gentle to flat slopes	Unconsolidated to poorly consolidated playa lake deposits; well consolidated to moderately consolidated sandstone and shales
Calico Mountains and Mudhills (MP 630-642)	Mojave Desert	Alluvium, volcanics, sedimentary rocks	Quaternary Permian Tertiary	Moderate relief moderate to steep slopes	Unconsolidated to poorly consolidated alluvium and playa deposits; volcanic flow rocks; moderately to well consolidated sedimentary rocks

Table 3.1-5 (continued)

GEOLOGIC AND PHYSIOGRAPHIC CONDITIONS, KERN RIVER PROPOSAL

Location	Geol/Phys Province	Geologic Unit	Age	Topography	Comments
Hinckley to Mojave (MP 645-713)	Mojave Desert	Alluvium, playa lake deposits; sedimentary rocks and granites	Quaternary Mesozoic	Low relief, gentle slopes to flat	Unconsolidated, poorly consolidated, and very hard granite
Tehachapi Mtns (MP 713-750)	Southern Sierra Nevada	Granite and sedimentary rocks	Mesozoic	High relief, moderate to steep slopes	Moderately hard to very hard granitics
Cummings & Brite Valleys (MP 730-746)	Southern Sierra Nevada	Alluvium	Quaternary	Low relief, gentle slopes	Unconsolidated to poorly consolidated material
Tejon Hills (MP 750-753)	Great Valley	Sedimentary rock, alluvium	Quaternary, Tertiary	Low relief, gentle slopes	Poorly consolidated rock
Southern San Joaquin Valley (MP 750-756)	Great Valley	Alluvial fans	Quaternary	Low relief; gentle to flat slopes	Unconsolidated deposits
Mettler to East of Bakersfield (MP KRL 0-22)	Great Valley	Alluvial fans	Quaternary	Low relief, flat	Unconsolidated fan deposits
Hills Northeast of Bakersfield (MP KRL 22-26.8)	Great Valley	Sedimentary rock	Quaternary Tertiary	Low relief, moderate slopes	Poorly consolidated rocks
Southern San Joaquin Valley (MP TL 0-47.1)	Great Valley	Alluvial fans	Quaternary	Low relief, gentle slopes to flat	Unconsolidated deposits
Buena Vista Hills, Buena Vista Valley, and Temblor Valley (MP TL 30-47.1)	Great Valley	Sedimentary rock, alluvium	Quaternary and Tertiary	Low relief, gentle slopes to flat	Unconsolidated to poorly consolidated material

form low linear ridges known as the cuestas. The steep faces of cuestas are normally composed of shales. In general, the area is stable with only occasional shallow landslides occurring in the steep shale faces. The overall relief is moderate, locally less than 300 feet and dissected to rolling.

Between MP 60-70 the route crosses a transition zone from the Wyoming Basin into the middle Rockies. Low rounded shale hills and short dissected drainages dominate the area. Local relief is less than 150 feet in this section.

Faulting and Seismicity. Historically, the Bridger Basin has been subjected to low intensity seismic events [Arabasz et al., 1979]. Earthquake ground acceleration values, estimated to have a 90 percent probability of not being exceeded in 50 years, varies from about 5 to 10 percent of gravity along this portion of the proposed route [Algermissen et al., 1982]. No Quaternary faults are known between MP 0 and 70.

Slope Stability. Several large deep-seated landslides have been mapped within the Chalk Creek area (MP 60-69) [Golder Associates, 1985]. A large active landslide is located between MP 67.5 and 68.

3.1.2.2 Middle Rocky Mountains (MP 70-185)

Geology and Physiography. This portion of the route crosses the Wasatch Plateau and Wasatch Front sections of the Middle Rocky Mountains. The topography along the pipeline route varies from highly dissected with low mountains to highly dissected and high mountains. The topography is rugged to very rugged. The area is underlain by recent alluvial deposits and Cretaceous Age and older sedimentary rocks and Tertiary volcanic rocks. Steep slopes, high groundwater tables, and rock outcrops are common features. Local relief exceeds 3,000 feet in many areas.

The proposed pipeline route follows ridgelines where possible. In several areas the route crosses zones with significant erosional or stability problems. The pipeline would also cross high mountain drainage divides (MP 126) where avalanches have been observed. Geologic and physiographic conditions along this portion of the route are summarized in Table 3.1-5.

Faulting and Seismicity. The area is considered to be seismically active. The proposed route crosses the southern portion of the Wasatch Fault Zone, between Nephi and Levan, near MP 185. Algermissen et al. [1982] estimate that, for a given 50-year period, there is a 90 percent probability that horizontal bedrock acceleration would not exceed 10 to 28 percent g along this portion of the route. This equates to a return period of approximately 500 years. The bedrock motion hazard increases southwestward from 10 percent g at the Utah-Wyoming border to 28 percent g along the Wasatch Fault. The Wasatch Fault Zone has not experienced an earthquake greater than magnitude 5.5 in almost 140 years [Cluff, 1980], and the time since the last surface faulting event may be several hundred years. However, detailed studies on fault exposures [Swan et al., 1980] strongly suggest that the area has experienced several earthquakes of magnitude 6.5 to 7.5, with associated fault ruptures, during the late Pleistocene and Holocene.

Slope Stability. Massive deep-seated landslides have been mapped in the area along sections of the proposed route. Preliminary field work by Golder Associates [1985] identified six zones along the proposed route within the Middle Rocky Mountains which have significant landslides or landslide potential. These are the South Fork Chalk Creek area (MP 74-85), the Lake Creek area (MP 109-112), the Strawberry River area (MP 114-118), the Pump Ridge area (MP 126-146), the Thistle area (MP 148-153), and the Salt Creek area (MP 178-181).

For the purposes of this study these areas will be addressed as landslide zones instead of addressing individual landslides by mile-marker within a zone. This is being done because even though active or historic landslides have been mapped, it is felt that these delineated areas should be viewed as potential landslide hazard zones; a landslide could develop at almost any point within these zones and not just where a landslide is currently mapped. The Tertiary Green River Formation and the Cretaceous North Horn Formation are particularly susceptible to landsliding. This approach is being utilized because recent aerial reconnaissance and data supplied by the Forest Service indicate that other previously unmapped slides exist within these zones along the proposed route [FS, 1986b]. This portion of the proposed route covers 12 miles of terrain identified by the Forest Service as mass stability hazard areas.

The South Fork Chalk Creek section (MP 74-85) has been identified by Kern River Gas Transmission Company as being the most unstable area along the proposed route. Over 25 landslides or features associated with slope instability were mapped by Golder Associates [1985] in this area. The proposed route crosses several of these landslides. In addition, during the aerial reconnaissance it was noted that many of the mapped slides were actually small slides which have developed within a much larger landslide system. This area has very high potential for significant landslide activity.

The Lake Creek area (MP 109-112) consists almost entirely of an older, possibly Pleistocene, landslide. Numerous small lakes and ponds have developed behind slump blocks. Numerous springs are evident in the area. The proposed route crosses the toe of this slide mass between MP 110.9 and 111.6. Although the area does not show signs of recent movement, significant landslide activity could occur along this section of the route.

The Strawberry River area (MP 114-118) also has an older landslide which the proposed route crosses. Locally shallow groundwater is evidenced by seeps and the presence of two "lakes" [Golder Associates, 1985]. This area has above-average potential for significant landslides to occur.

The Pump Ridge area (MP 126-146) of the pipeline route, which includes a 15-mile traverse along the crest of Pump Ridge, has numerous smaller landslides and landslide-prone areas [Golder Associates, 1985]. Field observations from aerial reconnaissance included numerous springs, slides, and potentially unstable areas. This area has high potential for significant landslide activity.

The Thistle area (MP 148-153) includes several significant slides. Between MP 148 and 152, the proposed route crosses within about 1500 feet of the head of the Thistle landslide. This area is very prone to landslides as evidenced by the presence of much older as well as recent landslides. Both very large and smaller scale landslides have occurred in this area. Significant landslides will continue to develop in this highly unstable area.

The Forest Service has identified numerous additional landslides, both on and adjacent to the proposed route in the Strawberry River, Pump Ridge, and Thistle areas, which were not addressed in the 1985 Golder Associates study. This fact emphasizes the significance of the landslide hazard along this portion of the route, and underscores the need for more detailed studies if the proposed Kern River project is certificated.

Several small slides were also noted from MP 160 to 170, with one noted along the proposed route on the west side of Mt. Baldy. The other observed landslides had developed on steep hillslopes and were not noted on the ridge along the route. This area has an above-average potential for landslide activity.

The Salt Creek area (MP 178-181) has several existing landslides. Both older and more recent landslides are present in this area. Some of the older slides have been mapped by Golder Associates [1985] as being very large. This area has high potential for significant landslide activity. Evidence of a seasonally high water table was observed in several areas. The proposed route crosses meandering streams in boggy, high mountain valleys and swift flowing streams in narrow canyon bottoms. The route does not cross any permanent snowfields.

3.1.2.3 Basin and Range (MP 185-535)

Geology and Physiography. The Basin and Range consists of a series of north-south trending down-thrown valleys which are paralleled by up-thrown mountains. Faults are found on the margins of the mountains and valleys. Gentle slopes and

Pleistocene lakebed sediments are associated with the valley floors. Steep, rugged, exposed Pennsylvanian sedimentary and Tertiary volcanic rock formations comprise the mountains, with moderately steep to gentle sloping alluvial fans forming the transition zone between the mountains and the valleys.

The proposed route is confined to the footslopes of the mountains, except where it is necessary to cross the intervening mountains. The route utilizes topographic lows or breaks to avoid the high mountain crossings. Geologic and physiographic conditions through the Basin and Range Region are summarized in Table 3.1-5.

Faulting and Seismicity. Several areas of Quaternary faulting occur along the segment are listed in Table 3.1-6. The area is considered to be seismically active. All of the Basin and Range has been subject to seismic activity in the past. The seismic events have varied from moderate to high intensity. Along this portion of the route, bedrock acceleration values of 16-20 percent of gravity (g) are estimated to have a 90 percent probability of not being exceeded over a 50-year period [Algermissen et al., 1982].

Seismically-induced soil liquefaction is a significant potential hazard in the valleys along the Wasatch Front and other areas where unconsolidated valley-fill and lacustrine deposits are saturated near the surface.

Slope Stability. Slopes along the pipeline route are generally stable. Some evidence of previous landslides was observed on the western boundary of the Pine Valley Mountains (MP 365-380).

Subsidence. Land subsidence has occurred over the past few decades in the Las Vegas Valley region. Significant overdrafting of groundwater from as early as 1946 to 1964 has resulted in the decline of groundwater levels and subsequent subsidence [Bell, 1981]. Localized subsidence also occurs in the Las Vegas Valley due to hydrocompaction [Bell, 1981]. Other areas may be susceptible to hydrocompaction if saturated.

3.1.2.4 Mojave Desert/Tehachapi Mountains/San Joaquin Valley (MP 535-756)

Geology and Physiography. The proposed pipeline would traverse three separate physiographic provinces in southern California. These include the Mojave Desert (MP 535-713), the Tehachapi Mountains (MP 713-750), and the San Joaquin Valley (MP 750-756). The Mojave Desert is made up of discrete ranges of rugged mountains flanked by alluvial fans and playa lake basins. The proposed route generally crosses alluvial fans and connecting basins.

Table 3.1-6

ACTIVE AND POTENTIALLY ACTIVE FAULTS, KERN RIVER PROPOSAL

Fault Name or Locale	Location on Proposed Route	Last Activity	Reference
Charleston	8 miles west of MP 114	Suspected Quaternary	Anderson and Miller [1979]
Wasatch	MP 184-186	Holocene	Anderson and Miller [1979]; Arabasz and Smith [1981]
Scipio Valley	MP 214-217	Quaternary	Morris [1978]; Anderson and Miller [1979]
Pavant Valley	MP 250	Suspected Quaternary	Anderson and Miller [1979]
Cove Fort Fault Zone	MP 260-280	Quaternary	Anderson and Miller [1979]
Minersville	MP 290	Late Quaternary	Anderson and Miller [1979]
Escalante	MP 324	Suspected Quaternary	Anderson and Miller [1979]
Parallels Grand Wish Fault	25 miles east of MP 375-385	Suspected Quaternary?	Anderson and Miller [1979]
Las Vegas Shear Zone	MP 482	Suspected Quaternary	Stewart and Carlson [1978]
Whitney Mesa	On route (MP 496-506)	Quaternary	Weide [1982a, 1982b]; Nakata et al., [1982]
State Line	MP 535	Quaternary	Jennings [1975, 1971]
Ivanpah	MP 545	Pre-Quaternary parallels State Line Faults	Jennings [1975, 1971]; Nakata et al., [1982]

Table 3.1-6 (continued)

ACTIVE AND POTENTIALLY ACTIVE FAULTS, KERN RIVER PROPOSAL

Fault Name or Locale	Location on Proposed Route	Last Activity	Reference
South Death Valley	MP 579	Pre-Quaternary	Jennings [1975]
Several Unnamed	MP 586, 595, 599, 603	Quaternary	Jennings [1975]
Coyote Lake	MP 607	Quaternary	Jennings [1975]
Manix	5 miles south of MP 610-620	1947, M=6.2	Jennings [1975]
Calico/ Blackwater	MP 636	Quaternary	Jennings [1975]
Harper	MP 645	Quaternary	Jennings [1975]
Lockhart	MP 656	Quaternary	Jennings [1975]
South Lockhart	MP 666	Quaternary	Jennings [1975]
Muroc	MP 688	Pre-Quaternary parallels Lockhart	Jennings [1975]
Garlock	MP 718	Holocene	Jennings [1975]
Tejon Canyon	MP 740	Pre-Quaternary connects to Garlock	Jennings [1975]
White Wolf	MP 756	1952, M=7.2	Jennings [1975]
Taft Lateral			
Buena Vista	MP 30	Active creep	Jennings [1975]
Unnamed (Elk Hills)	2 miles west of MP 47	Quaternary	Jennings [1975]
San Andreas	6 miles west of MP 47	Numerous historic	Jennings [1975]

As the proposed route traverses the western boundary of San Bernardino County near Mojave, it crosses into the Tehachapi Mountains, and exits through the Tejon Hills and low lying regions of the southern San Joaquin Valley around Mettler. Geologic and physiographic conditions through these three regions are discussed in Table 3.1-5.

Faulting and Seismicity. This portion of the proposed route has experienced a level of seismicity and faulting similar to that described for the Mojave project (Section 3.1.2.2, Volume I). Refer to Table 3.1-6 for the Kern River mainline fault crossings.

Slope Stability. This portion of the mainline through the Mojave Desert and Tehachapi Mountains exhibits slope stability problems similar to those described for the Mojave proposal mainline (Section 3.1.2.2 of Volume I).

Subsidence. Ground subsidence potential along this portion of the route is similar to the Mojave proposal route (see Section 3.1.2.2 of Volume I).

Volcanism. The mainline route would pass near the Lima Dome volcanic field in the Mojave Desert region (MP 560-570). This area is not currently active, nor has it been active in historic times. Minor dissection of flows suggests that the most recent activity was late Pleistocene or early Holocene.

Mineral/Petroleum Resources. See Section 3.1.2.2 of Volume I.

3.1.2.5 Kern River Lateral

Geology and Physiography. The Kern River Lateral route would lie within the eastern side of the extreme southern end of the San Joaquin Valley. The topography of the proposed route varies from a broad, flat valley (MP 0-22) to rolling and gently sloped alluvial fans coming off the foothills of the Greenhorn Mountains (MP 22-26.8). The segment of the proposed route that would traverse the San Joaquin Valley is underlain by alluvial fan deposits, while the route within the hills northeast of Bakersfield consists of sedimentary rock and alluvial fans.

Faulting and Seismicity. The proposed Kern River Lateral route has experienced a level of strong seismicity similar to the Mojave Kern Lateral (Section 3.1.2.3, Volume I). In addition to a crossing of the White Wolf Fault near the bifurcation of the Kern River mainline and the Kern River and Taft Laterals, two groups of small faults at MP 2 and 22 would be crossed. A portion of these ruptured as a result of the 1952 Kern County earthquake, but not where the pipeline would cross the faults [Jennings, 1975; Smith, 1964].

Subsidence. See Section 3.1.2.3 of Volume I.

3.1.2.6 Taft Lateral

Geology and Physiography. The proposed Taft Lateral would lie within the southern San Joaquin Valley region. The topography consists of gentle to flat slopes of low relief, and the geology is represented by unconsolidated alluvial fan deposits and some poorly consolidated sedimentary rock deposits of Quaternary to Tertiary age. Table 3.1-6 summarizes the geologic and physiographic features along the Taft Lateral.

Faulting and Seismicity. The Taft Lateral would cross very near a series of small faults that have shown evidence of movement with the 1952 Kern County earthquake at MP 10 [Jennings, 1975]. The Taft Lateral route has experienced a level of strong seismicity similar to that described for southwestern San Joaquin Valley (Volume I). The Buena Vista Fault would be crossed at MP 31.

Subsidence. See Section 3.1.2.2 of Volume I.

3.1.3 Soil

The distribution of soil mapping units along the proposed route and the characteristics of individual soils that comprise the soil mapping units are presented in Appendix A. This information has been summarized from numerous published and unpublished soil surveys as well as information from land management agencies. The soils characteristics presented in these tables are important to an assessment of soil impacts potentially resulting from pipeline construction, operation, and abandonment. Slope, depth class (quantity of material), and texture are important factors in the evaluation of topsoil suitability for use in reclamation. Slope and texture are also important factors for evaluating erosion susceptibility of the potentially affected soils. Summary descriptions of the soils identified along each proposed segment are presented below by geographic region. These regions do not correlate perfectly with the physiographic provinces used in the Geology Sections.

3.1.3.1 Kern River Mainline

3.1.3.1.1 Wyoming Basin (MP 0-40)

The portion of the proposed mainline route within the Wyoming Basin region traverses predominantly shallow and moderately deep soils on hills, ridges and plains. Deep soils are less common and occur in valleys and on fans. Topography ranges from undulating plains to steep-sided ridges. The soils of the Wyoming Basin region formed in material derived from sedimentary rocks, and modified by wind and water. Soil development ranges from little horizon differentiation on surfaces of recent age to soils with well developed subsoils or accumulations of calcium carbonate. Some soils are saline and/or alkaline. Surface organic matter content is low in most of these soils and desert pavements may be common. Soil fertility is mostly low. Soil susceptibility to water erosion is mostly low, but ranges from low on gentle slopes to high on steeper topography. Wind erosion potential is mostly moderate. Reclamation potential is mostly fair but ranges from fair to poor. Soil depth is the most extensive limiting factor. Reclamation potential is good on some deep soils in valleys [SCS, 1985b, 1985c; USFS, 1986d].

3.1.3.1.2 Middle Rocky Mountains (MP 40-185)

The portion of the proposed mainline route within the Wasatch Mountains section of the Middle Rocky Mountains region of northern Utah traverses predominantly deep soils on mountains, foothills, and valleys. Shallow soils are less common and occur on mountains and foothills. Topography ranges from gently sloping valleys, alluvial fans, and plateaus to steep mountains. The soils of this region formed in material derived from sedimentary rocks, and often modified by water. Soil development ranges from little horizon differentiation on surfaces of recent age, to well developed subsoils. Surface organic matter content is moderate to high. Soil fertility is mostly moderate to high. Soil susceptibility to water erosion is evenly distributed from low to very high, with low potential on gentle slopes and very high potential on steep slopes. Wind erosion potential is mostly low, but ranges from low to moderate. Reclamation potential is distributed over the good to poor range, but is mostly fair to poor. Soil depth, rock fragments, clayey texture, and steep slopes are the primary limiting factors [SCS, 1968, 1976b, 1978b, 1980a, 1981b; USFS, 1986c, 1986e].

3.1.3.1.3 Basin and Range (MP 185-390)

The portion of the proposed mainline route within the Basin and Range region traverses predominantly deep soils on fans, terraces and plains. Shallow soils are less common and occur on foothills and mountains. Topography is mostly level to rolling, with some steep slopes on mountains. The soils of the Basin and Range region formed in material derived primarily from sedimentary rocks but also from igneous and metamorphic rocks, and often modified by water. Soil development ranges from little horizon differentiation on surfaces of recent age to soils that have well developed subsoils, accumulations of calcium carbonate, and hardpans. Some soils are saline and/or alkaline. Surface organic matter content is low to moderate. Desert pavements may be common. Soil fertility is typically low. Soil susceptibility to water erosion is mostly low, but moderate to high on areas with steep slopes. Wind erosion potential is mostly low to moderate. Reclamation potential is distributed over the good to poor range, but mostly fair. Soil depth, rock fragments, salinity, alkalinity, and slope are the primary limiting factors [SCS, 1944, 1976a, 1977c, 1980c, 1984, 1986e; USFS, 1986b].

3.1.3.1.4 Mojave Desert (MP 390-711)

The portion of the proposed mainline route within the Mojave Desert region predominantly traverses intermingled deep soils and shallow soils with hardpans on alluvial fans, terraces and pediments. Shallow soils on mountains and foothills are not extensive. Topography is mostly level to rolling, with a few steep slopes on mountains. The soils in the Mojave Desert region formed in material derived from a variety of igneous to sedimentary rocks, and often modified by wind and water. Soil development ranges from little horizon differentiation on surfaces of recent age, to soils with well developed subsoils or hardpans on stable plains and alluvial fans. Some soils are saline and/or alkaline. Surface organic matter content is low due to the warm, arid environment. Desert pavements may be common. Soil fertility is mostly low. Soil susceptibility to water erosion is mostly low, but moderate to high on a few steep slopes. Wind erosion potential is evenly distributed from low to high. High potential occurs on areas with sandy soils. Reclamation potential is mostly poor. Soil depth, rock fragments, sandy texture, salinity and alkalinity are the primary limiting factors [SCS, 1967, 1977a, 1977b, 1980, 1981a, 1985a, 1986f].

3.1.3.1.5 Tehachapi Mountains (MP 711-746)

The portion of the mainline route within the Tehachapi Mountains region traverses predominantly deep soils and a small amount of intermingled shallower soils on sloping to steep mountainous uplands. Soils in mountain valleys are deep. The soils of the Tehachapi Mountains region formed in material derived from granite and schist, and often modified by water. Soil development ranges from little horizon differentiation on surfaces of recent age to soils that have well developed subsoils. Surface organic matter content is moderate to high. Soil fertility ranges from low to moderate. Water erosion potential is evenly distributed from low to high, with high potential on mountains and low to moderate potential in the valleys. Reclamation potential is fair to poor on the mountains and is primarily limited by slopes. In the valleys, reclamation potential is good to fair and is primarily limited by a few steeper slopes and areas with stones [SCS, 1967, 1981a, 1986f].

3.1.3.1.6 San Joaquin Valley (MP 746-756)

The portion of the mainline route within the San Joaquin Valley traverses deep soils. The soils of the San Joaquin Valley region formed in material derived from a variety of igneous, metamorphic and sedimentary rocks, and often modified by water. Most soils have little horizon development, though a few have well developed subsoils. Some soils are saline and/or alkaline. Surface organic matter content is low to moderate. Soil fertility ranges from low to very high. Water erosion potential is mostly low. Wind erosion potential is mostly low to moderate. Reclamation potential is mostly good [SCS, 1967, 1981a, 1986f].

3.1.3.2 Taft Lateral

Refer to Section 3.1.3.1.6 for a description of soils along this section of the route.

3.1.3.3 Kern River Lateral

Refer to Section 3.1.3.1.6 for a description of soils along this section of the route.

3.1.3.4 Compressor Stations

Soils at the site of Compressor Station No. 1 (MP 0) are typical of the Wyoming Basin as described above and range from shallow to moderately deep on undulating upland plains. Soil susceptibility to water erosion is low. Wind erosion potential is mostly moderate. Reclamation potential is poor. Salinity and alkalinity are the primary limiting factors [SCS, 1985b, 1985c].

Soils at the site of Compressor Station No. 2 (MP 260) are typical of the Basin and Range region as described above and are very deep and well drained on gently sloping topography. Water erosion potential is low. Wind erosion potential is mostly moderate and reclamation potential is fair, limited primarily by salinity and alkalinity [SCS, 1984].

Soils at the site of Compressor Station No. 5 (MP 516) are typical of the Mojave Desert as described above and are shallow to very deep and excessively drained. Topography is nearly level. Water and wind erosion potentials are low. Wind erosion potential is mostly low and reclamation potential is mostly poor due to coarse fragment content and quantity [SCS, 1977a, 1977b, 1985a].

3.1.4 Surface Water

The proposed route would traverse nine major drainage basins distributed within six distinct geographic regions. Approximately 52 perennial, 76 intermittent, and over 300 ephemeral drainage channels would be crossed by the proposed project. Approximately nine major transbasin diversions and irrigation canals would be crossed by the proposed project. Table 3.1-7 lists the major intermittent and perennial drainage channels that would be crossed by, or are in close proximity to, the proposed pipeline routes. The perennial streams are given a sensitivity rating relative to pipeline construction based on channel gradient and on topographic sideslope. These ratings are also presented in Table 3.1-7.

3.1.4.1 Wyoming Basin

Major U.S. Geological Survey (USGS) identified river basins that would be crossed by the proposed project and which drain this province include the Green River, a tributary to the Colorado River, and the Bear River which drains into the terminal Great Salt Lake. Stream flows within this province are primarily the result of snowmelt runoff, both surface and subsurface, with base flows sustaining minimal flows into the summer and winter months. Except for the Bear River which has relatively good water quality, the majority of these streams are somewhat alkaline and carry substantial sediment as bed, suspended, and wash loads. The Bear River, which rises in the high Uinta Mountains of Utah, is of good water quality and has many domestic, agricultural, and recreational uses. Many of the smaller perennial and intermittent streams that would be crossed have diversions for irrigation and agricultural use.

3.1.4.2 Middle Rocky Mountains

Major USGS drainage basins that would be crossed and which drain this province within the project area include the Bear, Weber, Jordan, Colorado, and Sevier Rivers. Only the Colorado River drains into the ocean, while the other rivers have terminal drainage in the Great Salt Lake Basin or the Great Basin. These rivers and their tributaries in the vicinity of the pipeline route arise in the high elevation terrain of the Wasatch and Uinta Mountains. Generally, these streams are characterized as having good to excellent quality. Most streams on Forest Service land meet or exceed Utah water quality standards. Peak discharges occur during the snowmelt season of April through June. Base flows sustain minimum flows in summer and fall months. The streams are most turbid during the high runoff snowmelt season, and generally clear up during the baseflow dominated season from June through March. Because of the relatively steep terrain within this province, the vast majority of streams that would be crossed are considered to be moderately to highly sensitive to crossing. This surface water is used for domestic, industrial, and agricultural uses along the Wasatch Mountains front in the vicinity of Salt Lake City as well as on small scattered agricultural operations within the Wasatch Mountains.

Table 3.1-7

MAJOR DRAINAGE CHANNELS, KERN RIVER PROPOSAL

Drainage Basin	Drainage Channel	Class 1/ Flow	Sensitivity 2/		Milepost
			Channel Bed	Side slope	
Green River	Dry Muddy Creek	I	-	-	2.5
	Little Muddy Creek	P	L	H	13.7
	Little Muddy Creek	P	L	H	14.8
	Little Muddy Creek	P	L	M	16.5
	Albert Creek	P	L	H	17.1
	Albert Creek	P	L	H	17.3
	Albert Creek	P	L	H	18.0
	Albert Creek	P	L	L	23.2
	Clear Creek	P	L	M	27.1
	Clear Creek	P	L	H	27.6-28.3
	Haystack Draw	I	-	-	33.9
	Byrne Creek	I	-	-	35.8
	Duncomb Hollow	I	-	-	43.9
	Blake Hollow	I	-	-	46.7
Bear River	Bear River	P	L	H	48.4
	Duel Hollow	I	-	-	48.7
	Coyote Creek	P	M	M	53.2
	Section Three Draw	I	-	-	53.8
	Cliffton Hollow	P	M	M	55.3
	Sage Creek Draw	P	M	M	58.0
	Yellow Creek	P	L	M	60.4
Weber River	Basin Creek	P	L	M	64.1
	Chalk Creek	P	L	M	67.5
	East Fork Chalk Creek	P	M	H	70.1
	Fish Creek	P	M	M	74.1
	South Fork Chalk Creek	P	M	M	79.0
	Neil Creek	I	-	-	83.3
	Perdue Creek	I	-	-	84.5
	Whites Creek	P	M	H	88.1
	Weber River	P	L	L	89.9
	Beaver Creek	P	M	M	95.9
Jordan River	Provo River	P	L	M	99.8
	Big Pole Creek	I	-	-	103.8
	Lake Creek	P	H	M	110.1-112.5
Colorado River	Strawberry River	P	M	H	114.1-115.9
	Strawberry River	P	H	H	115.9-117.3
	Strawberry River	P	M	L	117.3-121.2

Table 3.1-7 (continued)

MAJOR DRAINAGE CHANNELS, KERN RIVER PROPOSAL

Drainage Basin	Drainage Channel	Class 1/ Flow	Sensitivity 2/ Channel Bed	Side slope	Milepost
Colorado River	Wide Hollow	P	M	M	114.9
	Mill B Canyon	P	M	M	116.9
	Bjorkman Hollow	P	M	M	120.0
	Little Hobble Creek	P	L	M	122.5
Jordan River	Wanrhodes Canyon	P	M	H	141.6
	Little Diamond Creek	P	H	M	142.6
	Diamond Fork	P	M	M	146.2
	Diamond Fork	P	M	M	147.2
	Spanish Fork	P	M	H	148.8
	Crab Creek	P	H	H	152.0
	Aggie Creek	I	-	-	153.2
	Anderson Hollow	P	H	H	154.7
	Bennie Creek	P	H	M	155.9
	Hudson Hollow	I	-	-	157.0
	Gardner Hollow	I	-	-	157.9
	Nebo Creek	P	M	M	159.4
	Thistle Creek	P	M	H	154.0-158.5
Sevier River	Hop Creek	P	H	H	175.2
	Salt Creek	P	H	H	176.2
	Salt Creek	P	H	H	180.2
	Little Valley	I	-	-	181.5
	Old Piney Canyon	I	-	-	182.8
	Gardners Fork	I	-	-	184.0
	Fourmile Creek	I	-	-	185.5
	Chicken Creek Res.	P	L	H	195.0-197.0
	Chicken Creek	P	M	H	197.7
	Sevier River	P	L	M	202.6
	East Fork Ditch	-	-	-	223.2
	Pioneer Creek	I	-	-	230.8
	Unnamed	I	-	-	235.8
	Chalk Creek	I	-	-	238.6
	Unnamed Ditch	-	-	-	239.1
	Unnamed	I	-	-	263.8
	Cove Creek	I	-	-	270.8
	Unnamed	I	-	-	273.1
	Negro Mag Wash	I	-	-	282.2
	Unnamed	I	-	-	285.1
	Unnamed	I	-	-	285.9
	Ranch Canyon	I	-	-	287.6
	Corral Canyon	I	-	-	288.6
	Unnamed	I	-	-	292.1
	Unnamed	I	-	-	292.1

Table 3.1-7 (continued)

MAJOR DRAINAGE CHANNELS, KERN RIVER PROPOSAL

			Sensitivity 2/		
Drainage Basin	Drainage Channel	Class 1/ Flow	Channel Bed	Side slope	Milepost
Sevier River (continued)	High Line Canal	-	-	-	297.1
	Low Line Canal	-	-	-	297.7
	Trans River Canal	-	-	-	298.1
	Trans River Canal	-	-	-	299.3
	Bear River	I	-	-	299.4
	Unnamed	I	-	-	304.3
	Unnamed Ditch	-	-	-	305.5
	Unnamed	I	-	-	315.5
	Mud Spring Wash	I	-	-	322.6
	Iron Springs Creek	I	-	-	328.1
	Unnamed	I	-	-	332.1
	Dick Palmer Wash	I	-	-	334.7
	Unnamed	I	-	-	336.6
	Pinto Creek	I	-	-	352.5
	Holt Canyon	P	M	H	361.8
	Spring Creek	P	H	M	364.0
Virgin River	Magotsu Creek	P	H	H	373.9
	Moody Wash	P	H	H	376.9
	Cave Wash	I	-	-	377.3
	Tobin Wash	I	-	-	379.0
	Miners Canyon	I	-	-	381.9
	Monganese Wash	I	-	-	383.8
	Beaver Dam Wash	I-P	L	L	404.8
	Sand Hollow Wash	I	-	-	411.1
	Unnamed	I	-	-	416.0
	Toquop Wash	I-P	L	L	417.3
	Halfway Wash	I	-	-	427.5
Colorado River	Weiser Wash	I-P	L	L	445.3
	Muddy River	I-P	L	L	446.7
	California Wash	I	-	-	460.0- 472.0
	Gypsum Wash	I	-	-	483.3
	Las Vegas Wash	I-P	L	L	494.1
	Duck Creek	I	-	-	495.8
	Unnamed	I	-	-	505.8
Mojave River	Unnamed	I	-	-	507.5
	Unnamed	I	-	-	518.5
	Unnamed	I	-	-	526.1
	Unnamed	I	-	-	528.5
	Kingston Wash	I	-	-	552.9
	Unnamed	I	-	-	560.5
	Unnamed	I	-	-	563.6
	Riggs Wash	I	-	-	568.3

Table 3.1-7 (continued)

MAJOR DRAINAGE CHANNELS, KERN RIVER PROPOSAL

Drainage Basin	Drainage Channel	Class 1/ Flow	Sensitivity 2/ Channel Bed	Sensitivity 2/ Side slope	Milepost
Mojave River (continued)	Unnamed	I	-	-	582.0
	Unnamed	I	-	-	599.8
	Unnamed	I	-	-	601.6
	Unnamed	I	-	-	657.4
	Unnamed	I	-	-	706.6
	Second Las Angeles Aqueduct	-	-	-	711.1
Buena Vista Lake	Cameron Canyon	I	-	-	717.2
	Mendiburn Canyon	I	-	-	722.0
	Blackburn Canyon	I	-	-	722.6
	Antelope Canyon	I	-	-	724.6
	Water Canyon	I	-	-	727.5
	Brite Creek	I	-	-	729.8
	Cummings Creek	I	-	-	732.9
	Live Oak Canyon	I	-	-	735.2
	Tejon Creek	I	-	-	743.3
	Tejon Creek	I	-	-	743.4
	Calparallel Creek	I	-	-	747.6
Taft Lateral					
Kern River-San Joaquin Sink	Bitterwater Creek	I	-	-	25.8
	Sandy Creek	I	-	-	27.5
	Broad Creek	I	-	-	32.8
	Buena Vista Creek	I	-	-	37.5
Kern River Lateral					
Kern River-San Joaquin Sink	East Side Canal	-	-	-	16.0
	Kern River	P	L	L	24.1

1/ I = intermittent, P = perennial, - = ditch or canal, artificial flow

2/ Sensitivity
Channel Bed Gradient:
L = Low 0-1%, M = Moderate 1-3%, H = High > 3%
Sideslope (topographic slope):
L = Low 0-5%, M = Moderate 5-20%, H = High > 20%

3.1.4.3 Basin and Range

Major USGS river basins that would be crossed by the proposed project and which drain the region include the Jordan, Sevier, and Virgin Rivers. Except for the Virgin River which drains into the Colorado River, these rivers have terminal drainage in the Great Basin. Although these rivers were previously described for the Middle Rocky Mountains region, the tributary streams to the rivers within this region are markedly different. Most of the streams within this region rise in higher elevation terrain of semidesert mountain ranges and flow down onto surrounding alluvial fans where they become intermittent. The major source of runoff in these streams is snowmelt; however, spring, summer, and fall high intensity convective thunderstorms may produce peak discharges in great excess of those occurring from snowmelt. Because the majority of stream crossings would be on relatively dry alluvial fans and valleys where evaporation is high and naturally occurring salts are readily available, the water quality may be poor due to high alkalinity and turbidity. Because the majority of perennial streams that would be crossed occur in relatively low energy environments with respect to flow regime, the sensitivity of the stream environment to crossing is generally considered low. Most perennial and intermittent streams within this province are utilized for agricultural, industrial, or domestic use.

3.1.4.4 Mojave Desert

Major USGS river basins that would be crossed by the proposed project and which drain this region include the Virgin, Colorado, and Mojave Rivers. The Virgin River is a tributary to the Colorado River, while the Mojave River has terminal drainage within this province in California. Major intermittent to perennial drainages that would be crossed include Beaver Dam Wash, Toquop Wash, Las Vegas Wash, and Muddy River. Numerous topographic basins with terminal drainage would be crossed by the proposed project. The vast majority of stream flow within this province is in response to high intensity convective thunderstorms. Flows resulting from such storms are typically very flashy, may cover large areas within a given wash, and carry large quantities of sediment. Flows typically taper off quickly after the storm. Flows that do continue after the storm event are usually the result of increased baseflow. Due to the high evaporation environment of the Mojave Desert, streamflows when they do occur are typically highly alkaline which greatly lowers their utility.

3.1.4.5 Tehachapi Mountains

Within this region, the Mojave River and the Buena Vista Lake basins would be crossed. The streams that drain the east slope of the Tehachapi Mountains in the Mojave River basin are primarily ephemeral to intermittent and have characteristics very similar to that described under Mojave Desert province. A major aqueduct, the Second Los Angeles Aqueduct, would be crossed by the pipeline west of Mojave, California. Portions of the Tehachapi Mountains are high enough to receive a snowpack at higher elevations in the winter. In response to the snowmelt, many of the streams in the Tehachapi Mountains are intermittent to perennial and are of good quality. No perennial streams would be crossed by the proposed pipeline within this province.

3.1.4.6 San Joaquin Valley

Most of the streams that would be crossed by the proposed project rise in the surrounding mountains. These streams drain into the southern end of the San Joaquin Valley into the terminal Buena Vista Lake and Tulare Lake basins. The vast majority of surface water resources in this province are used for irrigation agriculture. Consequently, numerous irrigation canals and drains would be crossed by the proposed project within this province.

The only major perennial stream that would be crossed by the Kern River Lateral is the Kern River which has a headwater at 14,000 feet in the Sierra Nevada Mountains. Also, see Section 3.1.4.3 of Volume I for information about the Kern River.

3.1.5 Groundwater

Groundwater conditions along the proposed route are summarized in Table 3.1-8. Two major hydrogeologic regions occur along the proposed route. The first 180 miles of the proposed route cross the mountainous region of the Wyoming Basin and Middle Rocky Mountains regions. Groundwater in this region occurs under both confined (artesian) and unconfined (water table) conditions primarily in consolidated and semiconsolidated sedimentary strata. Sandstone, conglomerates, and limestone generally serve as aquifers in this region, with siltstone, claystone, and shale providing barriers to groundwater flow. Igneous and metamorphic rocks also affect hydrogeologic conditions in some areas.

Locally within the mountainous region along the proposed route groundwater occurs under unconfined conditions in the alluvium of major rivers. These alluvial deposits consist of nearly horizontal layers of sand, gravel, silt, and clay, with water levels being controlled by flow conditions in the adjacent rivers. Locations where the pipeline would cross major streams which may be associated with alluvial aquifers were discussed in Sections 3.1.4.1 and 3.1.4.2.

Yields to wells constructed in bedrock within the mountainous region are greatest where the bedrock is fractured. The yield of wells constructed in alluvium is proportional to the amount of sand and gravel encountered in the well. Generally, well yields

Table 3.1-8

GENERAL GROUNDWATER CHARACTERISTICS, KERN RIVER PROPOSAL

Pipeline Milepost	Minimum Depth to Water (ft)	Total Dissolved Solids Concentration (mgld)	Degree of Groundwater Development	References	Comments
0-60	>100 in bedrock 20-50 in alluvium	1000-3000	Low	Price and Arnow [1974] Eakin et al. [1976]	No major springs
60-80	50-200 in bedrock <20 in alluvium	<1000	Moderate	Gates et al. [1984]	No major springs
80-120	50-200 in bedrock 20-50 in alluvium	<500 in bedrock 500-1000 in alluvium	Moderate	Baker [1970]	No major springs
120-180	>100	<500	Low	Bjorklund [1967] Eakin et al. [1976]	Passes near Bradley Spring (flows 1800 gpm) used as public water supply. Other minor springs.
180-190	50-100 (except west of Levan, where depth <50)	<1000	High	Bjorklund [1967]	Wells used for irrigation
190-220	>200 (except near Scipio, where depth <50)	<1000	High	Bjorklund and Robinson [1968]	Numerous major springs near MP 195 (200-900 gpm each). Usage for irrigation and public supply.
220-260	80-500	200-1000	High	Mower [1965]	No major springs. Significant development for irrigation.
260-310	150-250	<1000	High	Mower and Cordova [1974]	Significant irrigation use. No major springs.
310-360	50-100	<700	High	Mower [1982]	Significant irrigation use.
360-410	>100	<700	Low	Cordova et al. [1972]	No major springs.
410-530	>200 (except near Las Vegas, where depth <100. Depth <10 at mile 500)	<1000 (except near Las Vegas, where TDS = 1000-3000)	High	Davidson [1979] Bedinger et al. [1984a]	No major springs. Large usage for public supply and irrigation.
530-640	>150 (except near playas, where depth <30)	<1000	Low	Bedinger et al. [1984b] Langer et al. [1984] Thompson et al. [1984]	No major springs.
640-756	>200 (except near playas and Mojave River, where depth <30)	<1000	High	Bedinger et al. [1984b] Langer et al. [1984] Thompson et al. [1984]	Major usage for irrigation and public supply. No major springs.

in excess of 50 gallons per minute are uncommon in the mountainous region [Price and Arnow, 1974].

Springs are common in the mountainous region, issuing primarily from bedding planes within the sedimentary rock (i.e., at contact points where more permeable bedrock such as sandstone overlies less permeable bedrock such as shale). These springs tend to be low yielding (less than 10 gallons per minute) and often do not sustain their flow throughout the year. On the other hand, springs issuing from fractures normally have more sustained and higher flows (commonly 10 to 100 gallons per minute). Groundwater flow conditions along this portion of the route are a significant contributing factor to the landslide hazard.

A few high-yielding springs in the region have been developed for domestic and irrigation use in communities located either in high mountain valleys or in the lower valleys bordering the mountains. Most of the low-yielding springs are used locally by livestock and wildlife as a water supply.

The chemical quality of groundwater in the mountainous region is good. Total dissolved solids concentrations are generally less than 1000 milligrams per liter and often less than 500 milligrams per liter. Locally high total dissolved solids concentrations occur in areas underlain primarily by siltstone and shale.

Groundwater along the remainder of the proposed route occurs in both unconsolidated basin-fill deposits and consolidated rocks. A general discussion of groundwater occurrence wtihin the Basin and Range physiographic province is provided in Section 3.1.5 of Volume I.

3.1.6 Freshwater Biology

Major perennial streams that would be crossed by the Kern River Proposal, along with their stream value classifications, are presented in Table 3.1-9. Sensitive fish species potentially affected by the proposal are listed in Table 3.1-11.

3.1.6.1 Wyoming Basin (MP 0-40)

General Freshwater Biology. Streams of the Wyoming Basin section of the pipeline route are small and perennial to intermittent in nature. Nine crossings of perennial streams would be required in the Wyoming Basin (Table 3.1-9), all of which have been classified by BIO/WEST as Class D. Species that occur in these streams include the longnose dace, mountain sucker, redside shiner and Utah chub.

Aquatic Species of Special Concern. No federal threatened and endangered species or federal candidate species are known to occur along this section of the pipeline route.

Table 3.1-9

FISHERY VALUE OF MAJOR PERENNIAL STREAMS, KERN RIVER PROPOSAL

State	County	Stream	Approximate Milepost	Fish Nongame	Fish Game	State 1/ Classification	BIO/WEST 2/ Classification
Wyoming Basin Region (MP 0-40)							
Wyoming	Uinta	Little Muddy Creek	13.7	X		NC	D
		Little Muddy Creek	14.8	X		NC	D
		Little Muddy Creek	16.5	X		NC	D
		Albert Creek	17.1	X		NC	D
		Albert Creek	17.3	X		NC	D
		Albert Creek	18.0	X		NC	D
		Albert Creek	23.2	X		NC	D
		Clear Creek	27.1	X		NC	D
		Clear Creek	27.6-28.3	X		NC	D
Middle Rocky Mountains Region (MP 40-185)							
Wyoming	Uinta	Bear River	48.4	X	X	2	B
		Coyote Creek	53.2			NC	U
		Clifton Hollow	55.3			NC	U
		Sage Creek Drain	58.0			NC	U
		Yellow Creek	60.4			4	B
		Basin Creek	64.1			NC	U
Utah	Summit	Chalk Creek	67.5	X	X	h-cw-3	B
		East Fork	70.1			NC	U
		Fish Creek	74.1			NC	U
		South Fork Chalk Creek	79.0	X	X	h-cw-3	B
		Whites Creek	88.1		X	h-cw-3	B
		Weber River	89.9	X	X	h-cw-3	B
		Beaver Creek	95.9	X	X	c-cw-2	A
	Wasatch	Provo River	99.8	X	X	c-cw-2	A
		Big Pole Creek	103.8		X	h-cw-3	B
		Lake Creek	112.0		X	h-cw-3	B
		Strawberry River	114.3		X	h-cw-3	B
		Wide Hollow	114.9			NC	U
		Mill B Canyon	116.9	X	X	h-cw-3	B
		Strawberry River	119.2		X	l-cw-6	C
		Bjorkman Hollow	120.0		X	s-cw-4	C
		Strawberry River	121.2		X	l-cw-6	C
		Hobble Creek	122.5	X	X	h-cw-3	B
	Utah	Wanrhodes Canyon	141.6	X	X	h-cw-3	B
		Little Diamond Creek	142.6	X	X	h-cw-3	B
		Diamond Fork	146.2	X	X	h-cw-3	B
		Diamond Fork	147.2	X	X	h-cw-3	B
		Spanish Fork	148.8	X		h-cw-3	B
		Crab Creek	152.0			NC	U
		Anderson Hollow	154.7			NC	U
		Bennie Creek	155.9	X	X	h-cw-3	B
		Nebo Creek	159.4		X	h-cw-3	B
	Juab	Hop Creek	175.2	X	X	h-cw-3	B
		Salt Creek	176.5	X	X	h-cw-3	B
		Salt Creek	180.2	X	X	h-cw-3	B

Table 3.1-9 (continued)

FISHERY VALUE OF MAJOR PERENNIAL STREAMS, KERN RIVER PROPOSAL

State	County	Stream	Approximate Milepost	Fish Nongame	Fish Game	State [1/] Classification	BIO/WEST [2/] Classification
Basin and Range Region (MP 185-390)							
Utah	Juab	Chicken Creek	197.7	X		l-cw-4	D
		Sevier River	202.6	X	X	h-cw-3	B
	Washington	Holt Canyon	361.8			NC	U
		Spring Creek	364.0			NC	U
		Magotsu Creek	373.9			NC	U
		Moody Wash	376.9			NC	U
Mojave Desert Region (MP 390-711)							
Nevada	Clark	Muddy River	446.7	X	X	1	B
San Joaquin Valley Region (MP 746-ends of both laterals)							
California	Kern	California Aqueduct	24.6 (Taft Lateral)	X	X	NC	C
		Kern River	24.1 (Kern River Lateral)	X		NC	D

[1/] Utah: The first letter (c) identifies one of the four use area rankings--c, critical; h, high priority; s, substantial value. The second group of letters (cw) identifies the primary type of fishery for which water is managed--cw, cold water fishery; ww, warm water fishery; ng, nongame fishery. The first number identifies one of the six stream classifications for the Utah State's fishery classification scheme, with 1 being the highest and 6 the lowest.

Wyoming:
1 High quality waters that are to be maintained at existing quality.
2 Waters that support game fisheries.
3 Waters that support nongame fisheries.
4 Waters that do not support fisheries.

Nevada:
1 Highest rating for streams within the State. Indicative of the presence of high value game fish or the presence of state or federally listed endangered species.

[2/] BIO/WEST Stream Classification:

A Stream area containing an excellent game fishery and/or federally listed endangered species. These streams are typically the most highly rated streams in state classifications.

B Stream area containing a high quality game fishery and/or candidate species for federally listed endangered species status or state sensitive species. These streams normally support the bulk of fishing use within a given state.

C Stream areas exhibiting limited or moderate game fisheries. In these waters fishing is considered a secondary use.

D Stream areas with few or no game fish, primarily inhabited by nongame fish. These areas are of no practical value as a fishery resource.

U Stream areas with no fishery resource, typically very small perennial or intermittent streams. These streams are frequently not classified by state agencies.

3.1.6.2 Middle Rocky Mountains (MP 40-185)

General Freshwater Biology. Perennial streams occurring in the Middle Rocky Mountains section of the route are generally cool to cold water trout streams. A total of 48 stream crossings would occur over this section of pipeline, of which 35 affect perennial streams (Table 3.1-9). Streams that would be crossed by the pipeline in this region are usually biologically diverse, supporting a complex assemblage of aquatic invertebrates, algae, and fish populations. Typically occurring fish species of these streams are listed in Table 3.1-10.

Table 3.1-10

TYPICAL FISH SPECIES OF PERENNIAL STREAMS, MIDDLE ROCKY MOUNTAINS REGION

Species	Game	Nongame
Cutthroat trout	X	
Rainbow trout	X	
Brown trout	X	
Brook trout	X	
Mountain whitefish	X	
Utah chub		X
Leatherside chub		X
Redside shiner		X
Fathead minnow		X
Speckled dace		X
Longnose dace		X
Mountain sucker		X
Utah sucker		X
Mottled sculpin		X

Two Utah streams, Beaver Creek and the upper Provo River, have been designated Class A streams, the highest rated stream category, by BIO/WEST. The Utah Division of Wildlife Resources has given these two streams a critical habitat designation. Critical habitat areas constitute irreplaceable habitat for which no loss of existing habitat value is acceptable.

Twenty-two stream crossings would occur in Class B streams, which are considered high quality fishing streams or contain sensitive species. One stream crossing would be in a Class C stream that supports a moderate valued game fishery. The remaining ten stream crossings occur in Class D and U streams and contain essentially no game fish populations.

Aquatic Species of Special Concern. Sensitive fish species that occur in drainages crossed by the pipeline route are listed in Table 3.1-11. Two federal candidate species, the Bonneville cutthroat and the leatherside chub, are known to occur in drainages that would be crossed by the pipeline within the Middle Rocky Mountains region [Archer, 1986].

Table 3.1-11

OCCURRENCE OF SENSITIVE FISH SPECIES, KERN RIVER PROPOSAL

Species	Federal 1/ Status	State 2/ Status	Geographic Region
Bonneville Cutthroat	C	R	Middle Rocky Mtns
Leatherside Chub	C	R,P	" " "
Moapa White River Springfish	C	-	Mojave Desert
Moapa River Speckled Dace	C	S	" "
Moapa Roundtail Chub	C	S	" "
Moapa Dace	E	P/E	" "

1/ C = Candidate for federal listing.
E = Federally listed endangered species

2/ R = Rare, P = Protected, S = Sensitive,
P/E = Protected/Endangered

3.1.6.3 Basin and Range (MP 185-390)

General Freshwater Biology. Most of the streams in this region are ephemeral to intermittent. Perennial streams that occur in this region tend to be warmer and more sediment-laden and influenced by spates than streams within the Middle Rocky Mountains region. Six perennial streams would be crossed by the 205 miles of pipeline that would lie within the Basin and Range region (Table 3.1-9). Potential species which could occur along the Basin and Range section of the route are listed in Table 3.1-12. Cold water game fish such as trout are limited to relatively few habitats in this region, while suckers, chubs and dace tend to predominate.

One stream is rated by BIO/WEST as a Class B stream while the remaining five streams are rated as Class D or U streams due to the lack of any substantial game fisheries. The Sevier River is the only stream crossed by the pipeline in this region with a high quality game fishery.

Aquatic Species of Special Concern. No state or federally listed species of special concern occur along this segment of the pipeline route.

Table 3.1-12

POTENTIAL FISH SPECIES, BASIN AND RANGE REGION

Species	Game	Nongame
Rainbow trout	X	
Brown trout	X	
Carp		X
Utah chub		X
Red shiner		X
Redside shiner		X
Utah chub		X
Speckled dace		X
Fathead minnow		X
Mosquito fish		X
Utah sucker		X
Mountain sucker		X
Channel catfish	X	
Black bullhead	X	
Largemouth bass	X	
Bluegill	X	

3.1.6.4 Mojave Desert (MP 390-711)

General Freshwater Biology. One perennial stream, the Muddy River, would be crossed by the pipeline in this region. The Muddy River is rated as a Class 1 stream by the State of Nevada and as a Class B stream by BIO/WEST.

Aquatic Species of Special Concern. One listed and three candidate species for federal endangered species status occur in drainages that would be crossed by the pipeline in the Mojave Desert region (Table 3.1-11). These species include the Moapa White River springfish, the Moapa River speckled dace, and the Moapa roundtail chub, all federal candidate species, and the Moapa dace, a federally listed species [Scoppetomne, 1986].

3.1.6.5 Tehachapi Mountains and San Joaquin Valley (MP 711-end)

General Freshwater Biology. No perennial aquatic or fishery resources occur along the Tehachapi Mountains section of the proposed route. The San Joaquin Valley section of the pipeline contains relatively few perennial streams or aquatic habitats. No aquatic habitats occur from MP 747 to the beginning of the Taft and Kern Laterals. The Taft Lateral would not cross any significant perennial streams. The only perennial aquatic habitat that would be crossed by this section of pipeline is the California Aqueduct. A relatively diverse fishery of both game and nongame species exists in the aqueduct. Predominant game species include channel catfish, striped bass and white catfish [BLM, 1984]. The lateral would also cross several small ephemeral washes and intermittent streams, but none contain significant fisheries resources.

The only significant habitat that would be crossed by the Kern River Lateral is the Kern River (Table 3.1-9). Overall, fisheries at the proposed crossing near Bakersfield are rated as Class D, comprised primarily of limited numbers of catfish and some native minnows [Christansen, 1986]. Fish are limited in abundance due to upstream water diversions, which may totally deplete stream flows near Bakersfield during dry years. Some significant fisheries, both cold water and warm water, occur upstream but are not near the proposed pipeline crossing.

Aquatic Species of Special Concern. No state or federally listed sensitive aquatic species occur near the pipeline in either the Tehachapi Mountains or the San Joaquin Valley region.

3.1.7 Terrestrial Biology

3.1.7.1 Vegetation

The proposed pipeline route would traverse six geographic regions, which are characterized by a unique set of geological and climatic conditions and do not perfectly correlate with the physiographic provinces presented in the Geology sections of this document. These include the Wyoming Basin, Wasatch Mountains section of the Middle Rocky Mountains, Basin and Range, Mojave Desert, Tehachapi Mountains, and San Joaquin Valley regions.

Vegetation along the route of the various components of the project is highly variable within each region as well as between regions. Approximately 17 different vegetation community types would be traversed. For the portions of the route within California, communities were designated according to a list of natural communities authored by the California Department of Fish and Game [1983]. Vegetation community type descriptions and mapping were based on published literature including BLM [1984], Cronquist et al, [1972], Foster [1985], Barbour and Major [1977], Twisselmann [1967], Cheatham and Haller [1975], and BLM [1980], as well as on-the-ground and aerial observation. Table 3.1-13 lists the community types that would be traversed by the proposed project and the mileposts at which they occur. These community types are described in Appendix B and their distributions shown in Map 5 of Volume IV.

Within the large array of community types along the proposed pipeline route, a similarly large variety of distinct habitats occurs. These distinct habitats may be exploited by plants with very limited distributions and occurrences, which are thus considered rare. Appendix C lists the plant species of special concern that occur in areas that would be traversed by the various project components as well as the geographic regions in which they occur. This appendix includes those species, as itemized by the U.S. Fish and Wildlife Service as well as state agencies and native plant societies, determined to have a reasonable potential of occurring in the vicinity of the pipeline route.

Table 3.1-13

VEGETATION COMMUNITY TYPES, KERN RIVER PROPOSAL

Geographic Region	Community Type	Milepost
Wyoming Basin	Mixed Desert Scrub	0-15
	Sagebrush Scrub	15-42
Wasatch Mountains	Pinyon-Juniper Woodland	42-44
	Sagebrush Scrub	44-48
	Wetland/Riparian	48-49
	Sagebrush Scrub	49-70
	Montane Forest	70-84
	Pinyon-Juniper Woodland	84-88
	Wetland/Riparian	88-89
	Agricultural land	89-91
	Sagebrush Scrub	91-98
	Wetland/Riparian	98-99
	Sagebrush Scrub	99-100
	Montane Forest	100-119
	Wetland/Riparian	119-121
	Sagebrush Scrub	121-122
	Montane Forest	122-128
	Mountain Brush	128-145
	Wetland/Riparian	145-146
	Mountain Brush	146-148
	Pinyon-Juniper Woodland	148-152
	Agricultural land	152-154
	Sagebrush Scrub	154-159
	Mountain Brush	159-179
	Pinyon-Juniper Woodland	179-181
	Sagebrush Scrub	181-185
Basin and Range	Agricultural land	185-192
	Sagebrush Scrub	192-202
	Wetland/Riparian	202-203
	Utah Grassland	203-207
	Sagebrush Scrub	207-211
	Pinyon-Juniper Woodland	211-214
	Sagebrush Scrub	214-219
	Pinyon-Juniper Woodland	219-225
	Agricultural land	225-233
	Pinyon-Juniper Woodland	233-236
	Agricultural land	236-249

Table 3.1-13 (continued)

VEGETATION COMMUNITY TYPES, KERN RIVER PROPOSAL

Geographic Region	Community Type	Milepost
Basin and Range (continued)	Wetland/Riparian	249-250
	Mixed Desert Shrub	250-254
	Utah Grassland	254-260
	Sagebrush Scrub	260-277
	Pinyon-Juniper Woodland	277-279
	Sagebrush Scrub	279-280
	Pinyon-Juniper Woodland	280-284
	Sagebrush Scrub	284-288
	Pinyon-Juniper Woodland	288-290
	Sagebrush Scrub	290-297
	Agricultural land	297-300
	Sagebrush Scrub	300-309
	Pinyon-Juniper Woodland	309-312
	Sagebrush Scrub	312-321
	Utah Grassland	321-325
	Mixed Desert Shrub	325-334
	Sagebrush Scrub	334-353
	Agricultural land	353-355
	Sagebrush Scrub	355-358
	Pinyon-Juniper Woodland	358-364
	Sagebrush Scrub	364-367
	Pinyon-Juniper Woodland	367-382
Mojave Desert	Blackbrush Scrub	382-394
	Joshua Tree Woodland	394-403
	Blackbrush Scrub	403-404
	Wetland/Riparian	404-405
	Blackbrush Scrub	405-410
	Joshua Tree Woodland	410-417
	Blackbrush Scrub	417-426
	Joshua Tree Woodland	426-428
	Blackbrush Scrub	428-436
	Mojavean Creosote Bush Scrub	436-441
	Blackbrush Scrub	441-445
	Agricultural land	445-446
	Wetland/Riparian	446-447
	Agricultural land	447-448
	Mojavean Creosote Bush Scrub	448-494
	Wetland/Riparian	494-495
	Mojavean Creosote Bush Scrub	495-542
	Mojavean Juniper Woodland and Scrub	542-544
	Mojavean Creosote Bush Scrub	544-559
	Joshua Tree Woodland	559-567
	Mojavean Creosote Bush Scrub	567-578
	Mojavean Shadescale Scrub	578-580
	Mojavean Creosote Bush Scrub	580-624

Table 3.1-13 (continued)

VEGETATION COMMUNITY TYPES, KERN RIVER PROPOSAL

Geographic Region	Community Type	Milepost
Mojave Desert (continued)	Agricultural land	624-627
	Desert Saltbush Scrub	627-628
	Mojavean Creosote Bush Scrub	628-653
	Mojave Saltbush/ [1] Agricultural land	653-667
	Mojave Saltbush [1]	667-692
	Mojavean Creosote Bush Scrub	692-711
	Joshua Tree Woodland	711-716
Tehachapi Mtn	Mojavean Juniper Woodland and Scrub	716-721
	Digger Pine-Oak Woodland	721-740
San Joaquin Valley	Valley and Foothill Grassland with Agricultural land	740-756
Kern River Lateral San Joaquin Valley	Valley and Foothill Grassland/ Agricultural land	0-24
	Great Valley Mixed Riparian Forest	24
	Valley and Foothill Grassland/ Agricultural land	24-27
Taft Lateral San Joaquin Valley	Valley and Foothill Grassland/ Agricultural land	0-48

---

[1] Western Mojave Desert Mojave Saltbush Unusual Plant Assemblage

Information on plant species of concern was obtained from several sources, including the U.S. Fish and Wildlife Service, Bureau of Land Management, state government agencies, native plant societies, and published documents pertaining to these species. Ranges and distributions are known for many of these plants along the proposed routes; however, in order to protect the species, this information is not included in this document at the request of the Federal Energy Regulatory Commission and the U.S. Fish and Wildlife Service. Of particular concern are plant species that are protected by Federal and California state law. The plant species of special concern which are protected are listed in Table 3.1-14.

Table 3.1-14

LEGALLY PROTECTED PLANT SPECIES, KERN RIVER PROPOSAL

Species	Status [1]	Mainline	Kern River Lateral	Taft Lateral
Clay phacelia	LE	Utah	-	-
Red rock tarweed	CA-R C1	Calif.	-	-
Tulare pseudobahia	CA-E C2	Calif.	Calif.	Calif.
Striped adobe lily	CA-T C2	Calif.	Calif.	Calif.
Bakersfield saltbush	CA-E C1	Calif.	Calif.	Calif.
California jewel flower	CA-E C2	Calif.	Calif.	Calif.

---

[1] LE = Federally listed endangered
C1 = Federal candidate, enough data on file to support federal listing
C2 = Federal candidate, insufficient data on file to support federal listing
CA-R = State of California protected rare
CA-E = State of California protected endangered
CA-T = State of California protected threatened

3.1.7.1.1 Kern River Mainline

Wyoming Basin (MP 0-40)

General Vegetation. The proposed mainline would traverse approximately two distinct community types within the Wyoming Basin region, including mixed desert scrub and sagebrush scrub.

Plant Species of Special Concern. One species of special concern, a milkvetch, may occur along the route in this region. The species is a federal candidate for listing (C2).

Middle Rocky Mountains (MP 40-185)

General Vegetation. Within the Wasatch Mountains region, approximately six distinct community types would be traversed by the proposed mainline including pinyon-juniper woodland, sagebrush scrub, wetland/riparian, mountain brush, montane forest, and agricultural land.

Plant Species of Special Concern. Two species of special concern may occur along the route in this region and include clay phacelia, which is a federally listed endangered species, and one federal candidate species (C2). Clay phacelia occurs on shale barrens of the Green River Formation at approximately 6,000 feet in the Wasatch Mountains of Utah.

Basin and Range (MP 185-390)

General Vegetation. Within the Basin and Range region, the proposed mainline would traverse approximately seven distinct community types including agricultural land, wetland/riparian, mixed desert scrub, sagebrush scrub, Utah grassland, and pinyon-juniper woodland.

Plant Species of Special Concern. Five species of special concern, all federal candidates for listing (four C2 and one C1), may occur along the route in this region.

Mojave Desert (MP 390-711)

General Vegetation. Within the Mojave Desert region, approximately eight distinct plant community types would be crossed by the proposed mainline including agricultural land, Mojavean creosote bush scrub, wetland/riparian, Joshua tree woodland, Mojavean shadscale scrub, Mojavean juniper woodland and scrub, blackbrush scrub, and desert saltbush scrub. In addition, a BLM-identified unusual plant assemblage, western Mojave Desert Mojave saltbush type, is also known to occur along the route within this region [BLM, 1980].

Plant Species of Special Concern. Fifteen plant species of concern may occur along the route within this region. These include primarily federal candidates for listing (eleven C2, three C3c, and one C1) as well as a species designated endangered by the State of Nevada, a wild buckwheat, and a State of California protected rare species, red rock tarweed. Red rock tarweed occupies habitat provided by perennial seeps, springs, and streams in the Mojave Desert in the vicinity of Red Rock State Park in California. The California Native Plant Society (CNPS) has major concern for all rare plant species in California.

Tehachapi Mountains (MP 711-746)

General Vegetation. The proposed mainline route would traverse approximately four community types within the Tehachapi Mountain region, including agricultural land, Mojavean juniper woodland and scrub, digger pine-oak woodland, and valley and foothill grassland. Narrow bands of riparian vegetation may occur along the intermittent stream channels within this region. These areas are generally beyond the level of resolution of this document.

Plant Species of Special Concern. Seven plant species of special concern may occur along the route within this region. These include federal candidates (five C2 and two C3c) as well as two State of California protected endangered species, California jewel flower and Tulare pseudobahia, and a protected threatened species, striped adobe lily. California jewel flower grows on sandy, non-alkaline soils in the valley and foothill grassland vegetation type. Tulare pseudobahia and the striped adobe lily grow on heavy adobe-clay soils within the valley and foothill grassland, and digger pine-oak woodland vegetation types.

San Joaquin Valley (MP 746-756)

General Vegetation. Within the San Joaquin Valley region, the proposed mainline (MP 746-756) would traverse three community types including agricultural land, valley and foothill grassland, and Great Valley mixed riparian forest.

Plant Species of Special Concern. Approximately sixteen plant species of special concern may occur along the mainline, Taft Lateral, and the Kern River Lateral including fifteen federal candidates (thirteen C2 and two C1), a rare plant of concern to the CNPS, as well as four State of California protected species. The California endangered species include California jewel flower, Tulare pseudobahia, and Bakersfield saltbush, and the threatened species, striped adobe lily. Bakersfield saltbush is confined to alkaline flats of the southern San Joaquin Valley within the valley and foothill grassland vegetation type.

3.1.7.1.2 Taft Lateral

General Vegetation. The Taft Lateral would traverse agricultural land and valley and foothill grassland.

Plant Species of Concern. Refer to Section 3.1.7.1.1 for the San Joaquin Valley.

3.1.7.1.3 Kern River Lateral

General Vegetation. The Kern River Lateral would traverse agricultural land, valley and foothill grassland, and Great Valley mixed riparian forest.

Plant Species of Concern. Refer to Section 3.1.7.1.1 for the San Joaquin Valley.

3.1.7.1.4 Compressor Stations

General Vegetation. Vegetation at the site of proposed Compressor Station No. 1 is of the mixed desert scrub type. Compressor Station No. 3 would be located within the Utah grassland type. Joshua tree woodland and Mojavean creosote bush scrub types occur at the site of Compressor Station No. 5.

Plant Species of Special Concern. Refer to Section 3.1.7.1.1 for the Wyoming Basin for a discussion on plant species of concern that may occur at Compressor Station No. 1; to the discussion for Basin and Range for Station No. 3; and to the discussion for the Mojave Desert for Station No. 5.

3.1.7.2 Wildlife

Wildlife species of high interest to appropriate state and/or federal agencies are presented under the individual geographic regions below. These species include game animals, raptors and other vertebrates that may be limited in distribution within the region. Table 3.1-15 lists important wildlife habitat features and their locations along the proposed pipeline. The specific geographic regions used in this section do not precisely correlate with the physiographic provinces used in the Geology section of this document.

Table 3.1-15

IMPORTANT WILDLIFE HABITAT FEATURES, KERN RIVER PROPOSAL

Milepost	Wildlife Concerns
3.5 - 4.5	Sage Grouse - critical breeding area
24.1 - 33.3	Sage Grouse - critical breeding area
24.6 - 33.0	Pronghorn Antelope - critical winter range
26.5 - 33.0	Raptor concentrations
49.5 - 50.0	Mule Deer - critical winter range
68.5 - 70.7	Moose - critical winter range
69.4 - 70.2	Elk - critical winter range
70.3 - 71.3	Elk - migration corridor
73.2 - 74.1	Elk - migration corridor
73.9 - 75.2	Moose - critical winter range
74.3 - 75.0	Mule Deer - critical winter range
74.3 - 79.6	Mule Deer - high priority
76.0 - 79.6	Moose - critical winter range
77.0 - 77.3	Mule Deer - critical winter range
78.2 - 79.3	Moose - migration corridor
79.8 - 80.9	Mule Deer - migration corridor
84.8 - 86.5	Mule Deer - migration corridor
85.8 - 87.2	Moose - critical winter range
86.2 - 88.4	Elk - high priority
87.3 - 87.5	Elk - critical winter range

Table 3.1-15 (continued)

IMPORTANT WILDLIFE HABITAT FEATURES, KERN RIVER PROPOSAL

Milepost	Wildlife Concerns
87.6 - 89.2	Mule Deer - critical winter range
89.5 - 98.2	Mule Deer - critical winter range Elk - high priority
99.9 - 100.9	Mule Deer - critical winter range
100.6 - 101.6	Mule Deer - migration corridor
100.8 - 100.9	Mule Deer - high priority
119.0 - 123.0	Sandhill Crane
121.0 - 135.0	Sage Grouse- breeding range
136.4 - 137.5	Elk - high priority
139.0 - 148.0	Raptor concentrations
140.3 - 146.9	Mule Deer - high priority
140.7 - 142.8	Mule Deer - critical winter range
140.7 - 142.9	Elk - critical winter range
146.9 - 147.8	Mule Deer - critical winter range Elk - high priority
148.1 - 150.6	Elk - critical winter range
150.6 - 166.1	Elk - high priority
150.9 - 166.1	Mule Deer - high priority
154.1 - 156.4	Mule Deer - critical winter range
151.1 - 155.0	Raptor concentrations
158.6 - 159.5	Mule Deer - critical winter range
162.0 - 164.4	Mule Deer - critical winter range
163.3 - 164.2	Elk - critical calving
167.5 - 168.9	Elk - critical calving
169.8 - 172.5	Mule Deer - high priority
170.8 - 172.0	Elk - high priority
172.6 - 186.2	Mule Deer - critical winter range
173.0 - 180.0	Raptor concentrations
176.0 - 185.0	Elk - high priority
191.2 - 196.0	Elk - high priority
195.0 - 198.0	Waterfowl - crucial nesting/brooding
200.0 - 202.0	Waterfowl - crucial nesting/brooding
208.0 - 225.0	Mule Deer - high priority
220.0 - 223.8	Mule Deer - critical winter range
229.0 - 230.0	California Quail - important habitat
233.0 - 237.0	California Quail - important habitat
233.2 - 235.2	Elk - critical winter range
236.0 - 244.0	Raptor concentrations
242.0 - 244.0	Pheasant - important winter habitat
262.9 - 269.8	Mule Deer - high priority
270.0 - 272.1	Sage Grouse - critical breeding area
278.1 - 279.4	Mule Deer - critical winter range
282.0 - 295.5	Mule Deer - high priority
305.0 - 309.0	Sage Grouse - critical breeding area
310.3 - 317.5	Mule Deer - high priority
331.2 - 331.9	Sage Grouse - critical breeding area
344.6 - 356.4	Mule Deer - critical winter range
356.4 - 362.4	Mule Deer - high priority

Table 3.1-15 (continued)

IMPORTANT WILDLIFE HABITAT FEATURES, KERN RIVER PROPOSAL

Milepost	Wildlife Concerns
366.0 - 367.4	Mule Deer - critical fawning area
376.3 - 381.8	Mule Deer - high priority
390.8 - 393.5	Mule Deer - high priority
413.0 - 416.0	Gambel Quail - critical habitat
420.0 - 429.0	Gambel Quail - critical habitat
488.0 - 493.0	Raptor concentrations
540.0 - 545.0	Raptor concentrations
586.0 - 588.0	Raptor concentrations
591.0 - 592.0	Raptor concentrations
596.0 - 597.0	Raptor concentrations
631.0 - 636.0	Raptor concentrations

Wildlife species of special concern include those listed by the U.S. Fish and Wildlife Service as threatened or endangered, candidates for such listing, state listed species, and BLM sensitive species. They are discussed for each geographic region where appropriate. Table 3.1-16 lists species of special concern, their status and the states in which they have been identified. Specific milepost locations have not been included to avoid potential harrassment of sensitive species and their suitable habitat. A list of wildlife species discussed for this proposal is presented as Appendix E-2.

Wildlife species and habitats along the proposed pipeline and variations have been analyzed for a mile wide-corridor, and is referred to in this document as the analysis corridor. All ancillary facilities associated with the proposed pipeline would lie within the analysis corridor. In addition, information is presented for the specific ROW, although it is understood that the proposed route has not been ground-surveyed and that deviations to these alignments are possible.

Presence and distribution of wildlife species and habitats have been delineated based on published literature, the data files of federal and state agencies, and on-site surveys conducted by BIO/WEST during June-August 1986 for species of special concern. At that time, the proposed route was not surveyed or staked and the pipeline route could only be delineated based on 1:24000 topographic quad sheets. Every attempt was made to accurately translate the mapped route to an actual ground alignment, but exact routing was impossible to follow. As such, this survey could only indicate the presence of targeted species in the immediate vicinity of the proposed alignment. The preliminary mapped route was sufficient to permit identification and quantification of suitable habitat, such as prairie dog colonies for black-footed ferrets, potentially traversed by the proposed pipeline.

Table 3.1-16

WILDLIFE SPECIES OF SPECIAL CONCERN, KERN RIVER PROPOSAL

Species/Status 1/	Mainline	Kern River Lateral	Taft Lateral	Compressor Stations
Bald eagle/FE,WY-E				
winter concentration	Utah	-	-	-
winter roost	Utah	-	-	-
California condor/FE,CA-E	Calif.	Calif.	Calif.	-
Desert bighorn sheep/NV-SS,BLM-S				
historic and year-long range	Nevada, Calif.	-	-	-
migration routes	Nevada, Calif.	-	-	-
Feral horse/FP	Utah, Nevada	-	-	-
Wild burro/FP	Nevada, Calif.	-	-	-
Black-footed ferret/FE,WY-E	Wyoming	-	-	#1 (Wyoming)
San Joaquin kit fox/FE,CA-T	Calif.	Calif.	Calif.	-
Utah prairie dog/FE	Utah	-	-	-
Giant kangaroo rat/FPE,CA-E	-	-	Calif.	-
Tipton kangaroo rat/FC	-	Calif.	Calif.	-
Short-nosed kangaroo rat/FC	-	-	Calif.	-
Nelson's antelope squirrel/FC,CA-T	-	-	Calif.	-
Mojave ground squirrel/FC,CA-T	Calif.	-	-	-

Table 3.1-16 (continued)

WILDLIFE SPECIES OF SPECIAL CONCERN, KERN RIVER PROPOSAL

Species/Status [1]	Mainline	Kern River Lateral	Taft Lateral	Compressor Stations
Blunt-nosed leopard lizard/ FE,CA-E	-	Calif.	Calif.	-
Tehachapi slender salamander/FC,CA-T	Calif.	-	-	-
Desert tortoise/ FT(UT),FC,BLM-S, NV-R,CA-P	Utah Nevada Calif.	-	-	#5 (Calif.)
Gila monster/ FC,NV-R	Nevada	-	-	-

---

[1] FE=federal endangered; FT=federal threatened; FC=federal candidate; FP=federal protected; FPE=federal proposed endangered; CA-E=California state endangered; WY-E=Wyoming state endangered; CA-T=California state threatened; CA-P=California protected; NV-R=Nevada state rare; N-SS=Nevada state sensitive; BLM-S=BLM sensitive

3.1.7.2.1 Kern River Mainline

Wyoming Basin Region (MP 0-40)

General Wildlife. Characteristic wildlife species associated with the Wyoming Basin vegetative communities include northern side-blotched lizard, northern sagebrush lizard, gopher snake, horned lark, rock wren, sage sparrow, Brewer's sparrow, white-tailed prairie dog, Richardson ground squirrel, longtail weasel, badger, striped skunk, mule deer and pronghorn [BLM, 1978].

The golden eagle, prairie falcon, and the burrowing owl are species of high interest to the State of Wyoming. Burrowing owls are strongly associated with prairie dog towns, and have been observed nesting in the Cumberland Valley area [BLM, 1985a; Ritter, 1986]. Although no burrowing owl nests are known for the analysis corridor, there are numerous prairie dog towns (>1600 acres) that provide potential nesting habitat [BLM, unpublished data f]. One golden eagle and one prairie falcon nest lie within the analysis corridor, although outside the ROW [BLM, unpublished data f].

Important game species in the vicinity of the analysis corridor are sage grouse, pronghorn and mule deer. Sage grouse are closely associated with sagebrush habitat, and as such occur over a large portion of this region. One known strutting ground (lek) is impinged upon by the pipeline ROW and an additional five are located within the analysis corridor in Cumberland Valley [Ritter, 1986]. One additional active lek site is located within the analysis corridor near the northern terminus of the proposed route [BLM, unpublished data f]. Pronghorn are widely distributed throughout the region and critical winter range would be traversed by the pipeline for approximately eight miles in the vicinity of western Cumberland Valley [BLM, unpublished data f].

Wildlife Species of Special Concern. Four federally listed species may occur within the affected area of the Wyoming Basin: bald eagle, peregrine falcon, whooping crane and black-footed ferret. Bald eagles are known to winter in the general region, and two winter roosts have been identified outside the analysis corridor [BLM, 1985a]. Peregrine falcons may occur in the area, but there are no known nests and only rare unconfirmed sightings. Whooping cranes are rare migrants in the region. Sightings have been reported for the Bear River drainage and from the Cumberland Valley, and probably represent birds migrating between Gray's Lake in Idaho and Bosque del Apache in New Mexico [BLM, 1985a].

Black-footed ferret habitat is strongly associated with prairie dog towns, and as such provide the potential for ferret occurrence throughout much of the affected area of the Wyoming Basin. Ground surveys indicated that approximately 600 acres of active prairie dog colonies exist within one-half mile of the alignment. Two ferret skulls were found in the Cumberland Valley in 1980 and were estimated to be five years old [BLM, 1985a]. At present there is no evidence that a viable ferret population exists in the affected area.

Two federally listed candidate species are known to reside within the generally affected area, Swainson's hawk and ferruginous hawk [BLM, 1985a]. No known nests occur within the analysis corridor [BLM, unpublished data f].

Middle Rocky Mountains (MP 40-185)

General Wildlife. Vertebrate species common to the sagebrush steppe and pinyon-juniper woodland communities and riparian habitat within the Middle Rocky Mountains region are similar to those for the Wyoming Basin region. Species common to montane and mountain brush include rufous-sided towhee, scrub jay, Clark's nutcracker, bushtit, pine siskin, northern goshawk, sharp-shinned hawk, porcupine, snowshoe hare, bobcat, mule deer, elk and moose [UDWR, unpublished data c,d; BLM, 1978].

Important waterfowl habitat in the vicinity of the proposed route is located along the Bear River in Wyoming, Kamas Valley and northern Strawberry Valley of Utah [BLM, unpublished data f; UDWR, unpublished data c,d]. The U. S. Forest Service has also identified 164 acres of sage grouse breeding and nesting habitat within the analysis corridor in the Uinta National Forest.

Four golden eagle nests lie within the analysis corridor. Two nests are located in the Diamond Fork drainage and two are in the area of Thistle Creek [UDWR, unpublished data c]. In addition, Salt Creek canyon contains one golden eagle nest which could possibly be within the pipeline ROW at MP 178.8 [UDWR, unpublished data c].

Important big game species include mule deer, elk, and moose. The analysis corridor of the proposed pipeline would traverse approximately 68 miles of high priority or critical deer winter range [UDWR, unpublished data c,d]. The proposed ROW would traverse a total of 51 miles of deer winter range. In addition the proposed route would cross three deer migration corridors; another one runs adjacent to the analysis corridor [UDWR, unpublished data c,d]. Elk winter range covers approximately 44 miles of the analysis corridor (six miles of critical range; 38 miles of high priority range), and the proposed ROW would traverse approximately 38 miles of this elk winter range [UDWR, unpublished data c,d]. The analysis corridor skirts two critical elk calving areas, but the ROW would impinge on less than a mile of this habitat [UDWR, unpublished data c,d]. Furthermore, the proposed route would cross three elk migration corridors [UDWR, unpublished data c,d]. Critical moose winter range has been identified for approximately nine miles of the analysis corridor, all of which would be directly traversed by the proposed ROW [UDWR, unpublished data c,d]. No calving areas or migration corridors would be affected by the proposed route.

Wildlife Species of Special Concern. Potential black-footed ferret habitat is limited to prairie dog colonies that would generally be found within the sagebrush steppe community. No prairie dog towns have been identified within the area of concern for this region [BLM, unpublished data f], although the potential for such colonies does exist. The whooping crane may be a very rare migrant visitor within the Strawberry Valley in association with sandhill cranes. No sightings are documented for the area of concern. Peregrine falcons may also occur within the area of concern as a rare migrant, although there are no recent sightings recorded. Two bald eagle winter roosts have been identified in Salt Creek Canyon [UDWR, unpublished data d]. Only one of these occurs within the analysis corridor.

No federal candidate species have been documented for the affected area, but the proposed route lies within the distribution of the western yellow-billed cuckoo, ferruginous hawk and Swainson's hawk.

Basin and Range (MP 185-390)

General Wildlife. Most of the wildlife species have wide distributions and are commonly found in appropriate habitats throughout the western United States. Characteristic species are similar to those described under the previous geographic regions.

The vicinity of Chicken Creek (MP 195-198) is considered critical nesting and brooding habitat for geese, and is probably also used by a variety of ducks [Nelson, 1986]. The Meadows adjacent to the Sevier River (MP 200-202) is considered critical waterfowl habitat by UDWR [Nelson, 1986]. This area is utilized by geese and ducks for nesting and brooding.

Two areas of high priority sandhill crane use have been identified: one is within the analysis corridor (MP 192-194), and the other is within the ROW through the Meadows of the Sevier River at MP 200-202 [UDWR, unpublished data c].

Important pheasant winter habitat is located on the proposed ROW in Pavant Valley at MP 242-244 [BLM, unpublished data h]. BLM [unpublished data h] has identified two important California quail habitat areas within the ROW at MP 229-230 and 233-237. Two sage grouse leks and associated breeding grounds are identified for the area of concern at MP 270-272 and 305-309; one of these leks may occur on the proposed ROW [BLM unpublished data a; UDWR, unpublished data b].

Four golden eagle nests are located west of Chicken Creek Reservoir, but only one of these nests encroaches upon the analysis corridor (MP 198) [UDWR, unpublished data c]. Eleven golden eagle nests have been documented along the Sevier River (MP 205-210); again, only one of these lies within the analysis corridor [UDWR, unpublished data c]. Two golden eagle nests are located along the analysis corridor west of Fillmore, Utah (MP 240), and a final one has been identified east of Newcastle, Utah (MP 352) [UDWR, unpublished data b,c]. In addition to these nests, UDWR has defined a broad area in Millard County, Utah, as a golden eagle summer use area [UDWR, unpublished data c]. The proposed ROW traverses this area between MP 236-244.

Big game populations within the vicinity of the proposed pipeline in this region include mountain lion, mule deer, elk and pronghorn. Critical mule deer habitat as defined by UDWR [unpublished data b] occurs along 17 miles of the pipeline and the proposed ROW would traverse seven miles. One critical fawning area is located along the analysis corridor within the Dixie National Forest for approximately 1.5 miles, but is not crossed by the ROW [UDWR, unpublished data b]. High priority deer winter range has been defined for 59 miles of the analysis corridor, and 44 of these miles are directly affected by the ROW [UDWR, unpublished data b,c]. Elk are limited in distribution along the proposed route, and critical and high priority habitat within the analysis corridor occurs for only two and five miles, respectively [UDWR, unpublished data c].

Wildlife Species of Special Concern. Two federally listed species have been identified as occurring within the analysis corridor: the Utah prairie dog and the bald eagle. Only one delineated Utah prairie dog population exists along the analysis corridor. This is a transplanted population along the perimeter of the corridor [UDWR, unpublished data b]. An on-site investigation by BIO/WEST, Inc. found this colony to be inactive. Four bald eagle roosts have been identified within the vicinity, although none of these encroaches upon the analysis corridor [UDWR, unpublished data c]. One large bald eagle winter concentration area has been delineated by UDWR [unpublished data b], and is crossed by the ROW for 14 miles.

The desert tortoise, a federal candidate species, is a federally threatened species at Beaver Dam Slope in southwestern Utah [USDI, 1980]. Tortoise populations and habitat sites have been identified through in-house data files of the Dixie Resource Area of the BLM. Because the tortoise and its habitat is sensitive to harrassment, exact locations of these sites are not delineated in this document. Although the proposed route would not cross the Beaver Dam Slope Critical Habitat, it would traverse two potential tortoise habitat areas (total of approximately two miles) north of the Critical Habitat [BLM, unpublished data b]. In addition, the analysis corridor encroaches on one tortoise winter denning site [BLM, unpublished data b].

The peregrine falcon may occur in the vicinity of this portion of the proposed route as a rare migrant. Federal candidate species potentially occurring in the area of concern are ferruginous hawk, Swainson's hawk, western snowy plover, mountain plover, long-billed curlew, white-faced ibis and yellow-billed cuckoo.

Mojave Desert (MP 390-711)

General Wildlife. Characteristic species of the region include desert iguana, western whiptail, zebratail lizard, coachwhip, rattlesnake, black-throated sparrow, verdin, cactus wren, roadrunner, black-tailed gnatcatcher, desert woodrat, desert cottontail, black-tailed jackrabbit, coyote and kit fox [MacMahon, 1985].

Water guzzlers are important artificial habitat features for some wildlife species in arid environments. They are often the only available free water source in an area, and as such tend to concentrate animals at one specific locality. Three guzzlers are located within the analysis corridor between MP 400-402 [BLM, unpublished data b]. Others may be present, but have not been identified.

Gambel's quail occur throughout the desert scrub habitat of this region, but only one area has been identified as crucial habitat. This area is east of the East Mormon Mountains, and is traversed by the proposed ROW for 12 miles from approximately MP 415-427 [BLM, unpublished data g].

Six golden eagle and prairie falcon nesting areas are located within the affected environment. Rainbow Gardens northeast of Las Vegas, Nevada, (MP 488-493) is the only area traversed by the pipeline in Nevada that has been identified as a concentrated nesting area [Turner, 1986]. Five nesting concentration areas are known for the Mojave Desert region in California [BLM, 1985b].

Wildlife Species of Special Concern. Habitat for one federally listed and California state endangered species, the California condor, would be crossed by the proposed route. Essential condor habitat extends east from the Tehachapi Mountains into the western edge of the Mojave region [BLM, 1984b]. The proposed pipeline would traverse this essential habitat.

The Mojave ground squirrel is listed as a threatened species by the State of California and as a federal candidate. Its distribution is limited to the desert scrub habitat of the western Mojave Desert of California, particularly the creosote bush scrub and saltbush scrub communities. The proposed route would cross approximately 70 miles of this habitat. Ground surveys in June-July 1986 confirmed the presence of Mojave ground squirrels along the proposed route.

Besides being listed as a federal candidate species, the Gila monster is also considered a Nevada state rare species. It is an uncommon inhabitant of sandy or rocky washes in southern Nevada, and believed to be rare in California [BLM, 1982; BLM, 1985b]. An area within the Muddy River riparian zone is the only Gila monster habitat that has been identified for the analysis corridor [BLM, unpublished data g].

The desert tortoise is listed as a federal candidate, a California BLM sensitive species, a Nevada state rare species, and is fully protected by the State of California under Sections 5000-5002 of the California Fish and Game Code 1983. Tortoise populations and habitat sites have been identified through the BLM [1982] for Nevada and Berry [1984] for California. Because the tortoise and its habitat is sensitive to harrassment, exact locations of these sites are not delineated in this document. Tortoises occur throughout the Mojave Desert Province primarily in creosote bush scrub and Joshua tree woodlands at lower elevations [BLM, 1985b]. Though populations occur throughout the province, they are scattered and vary in density according to local habitat conditions. In Nevada, the BLM has identified three crucial habitat sites (>40 tortoises per square mile) crossed by the proposed route for a total of 54 miles: Moapa, California Wash, and Goodsprings crucial habitats. In

California, the proposed ROW crosses 10 miles of high density habitat (100-250 animals per square mile), 20 miles of moderate density habitat (50-100 per square mile) and 19 miles of low density habitat (20-50 per square mile).

Swainson's and ferruginous hawks are likely to be common winter visitors in the region, but are unlikely breeders for the area. A potential nesting area for Swainson's hawk does occur in Shadow Valley in eastern California, and is crossed by the proposed route [BLM, 1985b].

The yellow-billed cuckoo is a federal candidate and a California threatened species. It is a resident of dense riparian habitat, and consequently only occurs in the area only as a rare migrant [BLM, 1985b].

The desert bighorn sheep is classified as a sensitive species by the State of Nevada and by the BLM. Bighorn sheep habitat occurs within much of the mountainous terrain crossed by the proposed route in Nevada and eastern California [BLM, unpublished data g; BLM, 1985b]. No known critical habitat is traversed, but four historic migration routes cross the proposed corridor.

Tehachapi Mountains (MP 711-746)

General Wildlife. The proposed route would traverse Mojavean juniper woodland and scrub, and digger pine-oak woodlands. Small game in the vicinity includes rabbit, California quail, mountain quail, chukar partridge, ring-necked pheasant, and possibly Merriam's turkey. Mule deer are the primary big game species. Raptors potentially occurring along the route include the red-tailed hawk, Cooper's hawk, sharp-shinned hawk, great-horned owl, and pygmy owl. It is not presently known if the proposed pipeline encroaches upon any active raptor nests.

Wildlife Species of Special Concern. The two, perhaps three, California condors remaining in the wild as of September, 1986 use habitat crossed by the proposed route through the Tehachapi Mountains. This range is considered essential condor habitat [BLM, 1984b]. Dead conifers provide sites for roosting and perching. In addition, the proposed route crosses the northern edge of critical condor habitat at Tejon Ranch. No known roost or nest sites occur within the analysis corridor [BLM, 1984b].

The federally listed endangered and California state threatened San Joaquin kit fox may occur along the proposed pipeline within the western foothills of this region; however, given the lack of recent sightings, this area is considered marginal habitat for kit fox [BLM, 1984b].

The Tehachapi slender salamander, a California state threatened species, may exist along north-facing slopes within moist canyons and ravines in oak-pine woodlands, and are frequently found under rotting logs and accumulated leaf litter [SCRA et al., 1980]. The proposed pipeline traverses less than one mile of suitable habitat for this species.

Federal candidate species potentially present on this portion of the proposed line include ferruginous hawk, Swainson's hawk, mountain plover, Tehachapi pocket mouse, and Morrison's, Moestan's, Moleston's and Hopping's blister beetles. The ferruginous and Swainson's hawks and the mountain plover occur as migrants. The Tehachapi pocket mouse may be found on the lower western foothills. The four species of blister beetles also occur in the western foothills of the Tehachapi Mountains.

San Joaquin Valley (MP 746-end)

General Wildlife. The proposed pipeline traverses the valley and foothill grassland community, and agricultural land. Small game species in the vicinity include cottontail rabbit, black-tailed jackrabbit, California quail, chukar partridge and ring-necked pheasant. No significant general wildlife habitat is defined within the analysis corridor for this geographic region.

Raptors potentially nesting in the area include white-tailed kite, red-tailed hawk, Swainson's hawk, northern harrier, prairie falcon, kestrel, screech owl, short-eared owl and burrowing owl [Small, 1974]. It is not known if the proposed pipeline encroaches upon any active nesting sites but much of the open valley is used for hunting.

Wildlife Species of Special Concern. The proposed pipeline would traverse the range of the federally listed and California state endangered California condor. The two, perhaps three, California condors remaining in the wild as of September, 1986 use habitat crossed by the proposed route through the lower foothills of the Tehachapi Mountains. This range is considered essential condor habitat [BLM, 1984b]. Open grassland areas with the potential for large dead animals such as cattle and sheep provide foraging opportunities within areas that ensure easy takeoff and approaches.

The kit fox, a federally listed endangered and California state threatened species, may be present in areas of natural grassland/shrubland vegetation where the slope gradient is minimal [BLM, 1984b]. Historical records indicate the presence of kit fox near the mouth of Tejon Canyon and the Comanche Point area. However, given the lack of recent sightings and the relatively dense stands of grasslands, the Tejon Hills are considered marginal habitat of kit fox [BLM, 1984b].

Five federal candidate species potentially occur along the analysis corridor in this region. The Swainson's hawk, ferruginous hawk, and mountain plover may be present as migrants or winter residents. The tricolored blackbird nests in wetland areas and feeds in croplands and open fields. The San Joaquin pocket mouse occurs in weedy or grassy areas with fine soils.

3.1.7.2.2 Kern Lateral

General Wildlife. This alignment lies within the San Joaquin Valley region and general wildlife species potentially occurring along this alignment are the same as discussed under the San Joaquin Valley Region of the Kern River mainline.

Wildlife Species of Special Concern. The few remaining California condors potentially utilize the limited open grasslands traversed by this proposed route for foraging.

Suitable San Joaquin kit fox habitat occurs along approximately five miles of this alignment south of Bakersfield, California. This area consists of atriplex/grasslands. Ground surveys conducted during July, 1986 confirmed the presence of kit fox in this general area. Kit fox may occur along the proposed route north of the Kern River in the oil lease area of Oildale; however, the high amount of human activity and densely packed oil extraction facilities may limit their abundance.

The blunt-nosed leopard lizard, a federally and California state endangered species, may occur along this alignment. This species prefers ecotonal areas of grasses interspersed with shrubby vegetation, and occurs on flat terrain and low foothills with soils suitable for rodent burrowing [BLM, 1984b]. They do not occur in croplands. Approximately four miles of this proposed line traverses such suitable habitat. Ground surveys conducted during June-July, 1986 confirmed the presence of blunt-nosed leopard lizards in the general area.

Federal candidate species potentially occurring include ferruginous hawk, Swainson's hawk, tricolored blackbird, San Joaquin pocket mouse, and Tipton's kangaroo rat. Swainson's and ferruginous hawks occur only as migrants or winter visitors. The tricolored blackbird nests in cattails and tules, and feeds in open fields. The San Joaquin pocket mouse occurs in weedy or grassy areas with fine soils. The Tipton kangaroo rat occurs on alluvial fan and floodplain soils ranging from fine sands to clay-sized particles, and are often associated with alkali sinks where their burrows are commonly located in slightly elevated mounds. Suitable habitat for the Tipton kangaroo rat is limited along the proposed alignment. Williams [1985] has delineated only one area presently inhabited by this species that would be crossed by the proposed route for approximately 0.5 miles.

3.1.7.2.3 Taft Lateral

General Wildlife. This alignment lies within the San Joaquin Valley region and general wildlife species potentially occurring along this alignment are the same as discussed under the San Joaquin Valley Region of the Kern River mainline.

Wildlife Species of Special Concern. The few remaining California condors potentially utilize the open grasslands traversed by this proposed route for foraging on livestock carrion.

The blunt-nosed leopard lizard, a federally and California state endangered species, occurs along this alignment. This species prefers ecotonal areas of grasses interspersed with shrubby vegetation, and occurs on flat terrain and low foothills with soils suitable for rodent burrowing [BLM, 1984b]. They do not occur in croplands. Approximately 24 miles of this proposed line traverse such suitable habitat along the western side of the San Joaquin Valley from the California Aqueduct to the terminus of the route near McKittrick. Ground surveys conducted during June-July, 1986 identified two populations with a total of four individuals along the proposed route within suitable habitat.

This proposed route traverses the only portion of the San Joaquin Valley floor in which the San Joaquin kit fox still occurs in substantial numbers; this is due to the relatively large extent of natural vegetation still present. Ground surveys during June-July, 1986 indicate suitable habitat is present along this proposed route from the crossing of the California Aqueduct to the terminus northwest of McKittrick (approximately 24 miles). Four active natal dens and 20 diurnal dens were observed in close proximity to the proposed route, and kit fox were seen nightly during spotlighting routes along this segment of the alignment.

The giant kangaroo rat, a federally proposed and California state listed endangered species, prefers relatively flat grassy terrain with fine sandy soils. The giant kangaroo rat is intolerant of agricultural activities and disappears rapidly following cultivation [Williams, 1980]. This species occurs throughout the western side of the San Joaquin Valley on the relatively flat valley floors [Williams, 1980]. Ground surveys during June-July 1986 identified 40 active colonies in the vicinity of the proposed pipeline between the California Aqueduct and McKittrick. The proposed alignment would cross approximately 15 miles of suitable giant kangaroo habitat.

The short-nosed kangaroo rat, a federal candidate species, prefers upland saltbush communities in the foothills and higher valleys on the south and west margins of the Tulare Basin [Williams, 1985]. They range from the western foothills east to the California Aqueduct [Williams, 1985]. As such the final 24 miles of this proposed route traverse potential habitat. Ground surveys during June-July, 1986 identified two active burrow systems within one discrete area of the proposed alignment in the lower Buena Vista Valley.

Suitable habitat for the Tipton kangaroo rat is limited along this alignment. Two small discrete locations totaling approximately two miles of this alignment have been described by Williams [1985] as potentially supporting this species.

The Nelson's antelope squirrel is a federal candidate for listing and a California state threatened species. This species is associated with moderate stands of Atriplex polycarpa on the west side of the San Joaquin Valley. Burrows are frequently dug in banks of arroyos, road cuts, and along pipelines and drilling platforms [Williams, 1980]. The proposed route would traverse approximately 24 miles of Nelson's antelope squirrel range from the California Aqueduct north to its terminus near McKittrick. Ground surveys during June-July, 1986 recorded 15 squirrels along this segment of the proposed route.

Ferruginous hawk, Swainson's hawk, tricolored blackbird, and San Joaquin pocket mouse potentially occur along this alignment. Swainson's and ferruginous hawks occur only as migrants or winter visitors. The tricolored blackbird nests in cattails and tules, and feeds in open fields. The San Joaquin pocket mouse occurs in weedy or grassy areas with fine soils.

3.1.7.2.4 Compressor Stations

General Wildlife. Compressor Station No. 1 would occur within the sagebrush steppe community of the Wyoming Basin Region. Typical wildlife associated with this community has been described under the Kern River mainline. No designated important wildlife species or habitats are present at this site.

Compressor Station No. 3 would occur in the Utah grassland community of the Basin and Range region. Typical wildlife associated with this community has been described under the Kern River mainline. No designated important wildlife species or habitats are present at this site.

Compressor Station No. 5 would occur in the Mojavean creosote bush scrub community of the Mojave Desert Region. Typical wildlife associated with this community has been described under the Kern River mainline.

Wildlife Species of Special Concern. An active prairie dog colony has been identified within the immediate vicinity of Compressor Station No. 1. Although no prairie dogs have been identified at the immediate compressor station site, approximately 150 acres of active burrows occur within 0.5 miles. This active prairie dog town provides suitable habitat for black-footed ferrets.

No species of special concern have been identified within 0.5 miles of Compressor Station No. 3.

No species of special concern have been identified within the vicinity of Compressor Station No. 5. There does exist suitable habitat for desert tortoise, although the area of concern has not been designated as habitat supporting a relatively high density of tortoises.

3.1.7.3 Grazing

The proposed pipeline would traverse a wide array of grazing allotments with federal, state, and private ownership. Detailed information on grazing allotments along the proposed route may be found in Appendix D. Because state lands are often grazed in conjunction with adjacent private lands and stocking rates of the combined allotments are often non-ownership specific, grazing information on state lands has not been included in Appendix D.

The mainline of the Kern River proposal would intersect 46 livestock grazing allotments under BLM jurisdiction and nine under USFS. These allotments range from 2,163 to 459,302 acres in size. Cattle and sheep are the predominant livestock on the permanent allotments. There is no known grazing on federal lands traversed by the proposed Taft and Kern River Laterals. Several allotments on the Naval Petroleum Reserve 2 border the Taft Lateral.

3.1.8 Socioeconomics

The study area includes 18 counties in four states: two in California, two in Nevada, 12 in Utah, and two in Wyoming. The major emphasis in terms of the regional unit for which data are presented is the county. In the case of some of the counties, data are presented for cities or towns that are within 50 miles of a proposed pipeline route and hence may be disproportionately affected relative to the rest of the county. Only cities with 2,500 or more inhabitants are considered due to data availability. Emphasis is also placed on those counties that have relatively greater amounts of project construction or are likely to serve as either supply facilities or workforce bases for the construction workers. There is little reason to provide in-depth profiles of counties in which very little activity is predicted or that do not have the economic infrastructure to serve as a supply or workforce base.

To avoid unnecessary repetition, the 18 counties and the affected cities that constitute the affected environments for the mainline proposal and alternatives are profiled in three tables. These tables are referenced throughout the entire volume, but are presented once. Table 3.1-17 presents the population and housing characteristics of each of the counties. Table 3.1-18 describes the economic characteristics of the counties. Table 3.1-19 presents data for selected cities along the pipeline routes and includes many of the data elements for each city that were presented for each county in the previous two tables.

Table 3.1-17

POPULATION AND HOUSING CHARACTERISTICS OF AFFECTED COUNTIES, KERN RIVER PROPOSAL

		Population			Percent of Population by Age		
State/County	Land Area (Sq. Miles)	1980	1984	Percent Increase	0-17	18-64	65+
CALIFORNIA							
Kern	8,130	403,089	462,400	14.7	30.9	59.4	9.7
San Bernardino	20,064	895,016	1,033,700	15.5	30.2	59.8	10.0
NEVADA							
Clark	7,881	463,087	536,500	15.8	27.7	64.7	7.6
Lincoln	10,635	3,732	3,500	5.0	36.0	51.2	12.8
UTAH							
Beaver	2,586	4,378	5,100	16.6	36.2	49.8	14.0
Davis	299	146,540	169,300	15.5	41.5	54.1	4.4
Iron	3,301	17,349	19,800	13.9	37.7	54.9	7.4
Juab	3,396	5,530	6,100	10.9	38.1	49.2	12.7
Millard	6,818	8,970	12,800	42.9	40.1	47.3	12.6
Morgan	603	4,917	5,200	6.0	41.9	50.9	7.2
Salt Lake	756	619,066	697,400	12.6	35.6	56.9	7.5
Sanpete	1,587	14,620	16,800	15.0	37.7	49.1	13.2
Summit	1,865	10,1998	12,600	23.8	35.4	57.6	7.0
Utah	2,018	218,106	240,600	10.3	37.4	56.5	6.1
Wasatch	1,191	8,523	9,700	14.3	39.5	51.4	9.1
Washington	2,422	26,065	33,100	26.8	37.9	48.8	13.3
WYOMING							
Lincoln	4,070	12,177	14,600	19.8	38.4	53.4	8.2
Uinta	2,085	13,021	23,600	81.2	35.8	58.2	6.0

SOURCES:
Land Area, Percent Population by Age:
County and City Data Book, 1983, 10th Edition, U.S. Department of Commerce, Bureau of the Census.
Population, Percent Increase in Population:
Current Population Reports, Local Population Estimates, 1985, U.S. Department of Commerce, Bureau of the Census.

Table 3.1-17 (continued)

POPULATION AND HOUSING CHARACTERISTICS OF AFFECTED COUNTIES, KERN RIVER PROPOSAL

	Permanent Housing 1980							1985 Temporary Housing	
State/County	Total Year Round Units	Single Units	Units in Multiple Unit Structures	Percent Year Round Units Vacant	Vacant Housing Units	Units For Rent	Percent Rental Vacancy	Hotel/ 1/ Motel Rooms	RV Spaces
CALIFORNIA									
Kern	154,321	109,105	45,216	9.4	14,510	4,478	7.6	3253	553
San Bernardino	366,136	277,531	88,605	15.7	57,493	9,933	9.2	2630	1,234
NEVADA									
Clark	189,860	102,904	86,956	8.4	15,969	8,247	10.4	55,600	2,829
Lincoln	1,673	964	709	24.1	403	84	18.3	n/a	12
UTAH									
Beaver	1,636	1,433	203	12.7	208	30	11.8	0 2/	365
Davis	41,549	32,824	8,725	3.7	1,555	450	4.8	0	460
Iron	5,964	4,151	1,813	13.3	796	128	9.3	400	163
Juab	1,930	1,658	272	11.6	223	66	19.7	0	0
Millard	3,141	2,805	336	13.1	413	46	8.9	0	53
Morgan	1,381	1,275	106	1.9	26	4	1.8	0	641
Salt Lake	214,266	147,629	66,637	5.8	12,524	5,343	7.7	10,000	140
Sanpete	5,160	4,417	743	13.7	706	89	10.9	0	199
Summit	4,881	3,417	1,464	30.7	1,500	322	26.7	0	576
Utah	62,226	42,065	20,161	6.0	3,711	1,310	6.0	2060	290
Wasatch	2,886	2,291	595	10.1	291	50	7.8	200	441
Washington	9,066	6,373	2,693	14.0	1,265	185	9.3	2000	
WYOMING									
Lincoln	4,321	3,102	1,219	10.7	462	133	13.9	278	0
Uinta	4,428	2,400	2,028	7.9	348	139	12.1	1351	94

1/ Near ROW and selected cities
2/ see text

SOURCES:
Total Year Round Units, Single Units, Units in Multiple Unit Structures, Year Round Units Vacant:
County and City Data Book, 1983, 10th Edition, U.S. Department of Commerce, Bureau of the Census.
Vacant Housing Units, Units for Rent, Rental Vacancy Rates:
General Housing Characteristics, 1980 Census of Housing, U.S. Department of Commerce, Bureau of the Census.
Hotel, Motel Rooms, Temporary Housing Vacancy:
Various personal communications with Chambers of Commerce, City and County Planners, and state offices of tourism.

Table 3.1-18

INDUSTRIAL STRUCTURE AND SALIENT ECONOMIC CHARACTERISTICS, KERN RIVER PROPOSAL

State/County	Total Employment 1984 Avg	Total Employment Dec. 1985	Percent Employment by Industry 1983/1984 1/ Agriculture	Manufacturing	Trade	Mining	Services	Percent Unemployment 1984 Avg	Percent Unemployment Dec. 1985
CALIFORNIA									
Kern	190,230	200,932	1.84	8.11	30.97	9.49	24.39	12.2	10.6
San Bernardino	349,458	366,827	0.56	16.57	34.37	0.94	28.43	8.0	5.9
NEVADA									
Clark	255,153	259,723	0.56	3.62	24.06	0.13	52.96	8.6	8.6
Lincoln	2,583	2,608	0.00	A	48.41	B	22.22	5.6	6.2
UTAH									
Beaver	2,053	2,457	A	3.44	50.29	A	27.15	7.3	5.9
Davis	71,391	77,105	0.23	17.95	38.72	0.36	22.75	4.5	3.8
Iron	7,930	8,508	A	9.35	43.58	A	23.68	7.0	5.9
Juab	1,821	1,709	0.00	27.51	41.84	B	11.89	15.2	18.9
Millard	7,444	8,100	A	20.18	29.50	0.00	23.76	6.5	7.8
Morgan	2,039	2,038	0.00	C	15.56	0.00	11.75	4.5	5.7
Salt Lake	296,073	325,736	0.21	18.91	29.29	1.27	26.32	6.1	5.7
Sanpete	6,133	5,610	A	30.45	29.91	A	20.00	11.3	15.7
Summit	8,447	9,801	0.27	2.46	28.34	8.19	32.49	7.1	4.2
Utah	84,245	93.827	0.23	20.34	22.52	G	40.94	6.9	6.7
Wasatch	2,582	2,524	A	13.78	41.60	A	28.07	15.1	15.0
Washington	11,082	12,521	B	11.53	38.42	0.69	25.10	6.3	4.8
WYOMING									
Lincoln	5,597	6,221	A	11.59	27.86	F	14.86	9.8	9.6
Uinta	10,485	10,717	A	3.43	38.65	11.95	21.24	6.3	8.1

1/ A = 0-19 employees
B = 20-99 employees
C = 100-249 employees
E = 250-499 employees
F = 500-999 employees
G = 1000-2499 employees

SOURCES:
Total Employment, Percent Unemployed:
Local Area Unemployment Statistics, 1/84-12/85, U.S. Department of Labor, Bureau of Labor Statistics.
Percent Employed by Industry:
County Business Patterns, 1983-CA,TX,WY,US; 1984-AZ,CO,NV,NM; U.S. Department of Commerce, Bureau of Census.

Table 3.1-18 (continued)

INDUSTRIAL STRUCTURE AND SALIENT ECONOMIC CHARACTERISTICS, KERN RIVER PROPOSAL

State/County	1984 Retail Sales (Millions)	Measures of 1983 Income: Per Capita (Dollars)	Measures of 1983 Income: Personal (Millions)	Measures of 1983 Income: Wages and Salaries (Millions)
CALIFORNIA				
Kern	$2,471.7	$10,848	$4,847.1	$3,040.6
San Bernardino	4,990.8	10,723	10,695.2	4,873.4
NEVADA				
Clark	3,839.1	12,052	6,274.4	4,252.9
Lincoln	8.1	10,035	36.4	36.4
UTAH				
Beaver	19.2	6,830	33.7	16.3
Davis	623.1	8,826	1,455.7	915.0
Iron	127.4	7,259	138.9	75.9
Juab	21.5	6,910	40.9	16.8
Millard	40.0	7,168	82.8	60.4
Morgan	8.3	9,856	51.6	15.3
Salt Lake	3,553.1	10,144	6,953.6	5,136.1
Sanpete	26.4	6,258	103.1	41.4
Summit	66.0	10,856	130.4	67.7
Utah	834.4	6,741	1,588.0	864.7
Wasatch	31.7	7,854	73.8	25.1
Washington	155.3	7,374	228.7	86.7
WYOMING				
Lincoln	82.0	9,998	145.1	91.7
Uinta	225.1	9,934	222.5	167.2

SOURCES:
Retail Sales:
Sales and Marketing Management, Bill Communications, July 22, 1985 issue.
Income:
Local Area Personal Income, Volumes 7,8,9, June 1985, U.S. Department of Commerce, Bureau of Economic Analysis.

Table 3.1-19

SOCIOECONOMIC CHARACTERISTICS OF SELECTED CITIES, KERN RIVER PROPOSAL

	Population			Permanent Housing Units 1980		Temporary Housing Units 1985				
State/City	1980	Current	Percent Change	Number	Vacancy Rate %	Motel Rooms	Vacancy Rate %	RV Spaces	1985 Per Capita Personal Income 1/	Employment 1985
CALIFORNIA										
Bakersfield	105,611	129,686	23	42,761	7.39	2,758	35	264	$12,181	54,600
Barstow	17,690	18,824	6	6,717	8.08	1,350	50	238	10,432	9,000
Needles	4,120	5,000	21	1,730	9.83	580	50	440	11,270	1,988 2/
Victorville	14,220	20,00	41	6,108	12.61	688	n/a	203	9,842	8,340
NEVADA										
Henderson	24,363	37,600	54	8,889	9.98	625	n/a	0	10,653	14,000 2/
Las Vegas	164,674	229,466	39	67,133	7.43	53,600	n/a	2,675	12,057	85,440 2/
UTAH										
Brigham City	15,596	17,650	13	4,847	3.86	150	n/a	75	9,297	13,700 3/
Cedar City	10,972	12,014	9	3,591	7.24	400	n/a	163	8,301	5,119
Heber	4,362	4,938	13	1,497	7.55	200	n/a	155	7,511	1,853
Logan	26,844	28,963	8	9,893	6.09	540	n/a	25	8,228	16,207
Ogden	64,407	66,699	4	25,675	6.58	1,000	n/a	148	9,691	24,330
Orem	52,399	60,500	15	14,826	5.87	20	n/a	0	7,871	20,000
Provo	74,108	81,000	9	21,284	5.64	2,040	n/a	484	7,135	31,380
St. George	11,350	18,500	63	4,151	13.54	2,000	n/a	107	7,735	6,508
Salt Lake	163,033	174,640	7	72,830	7.21	10,000	n/a	641	10,981	52,005
WYOMING										
Evanston	6,421	11,120	73	2,315	7.08	1,255	n/a	22	12,446	9,981
Green River	12,807	13,780	8	4,237	6.07	165	n/a	55	12,612	11,035
Kemmerer	3,273	4,000	22	1,302	11.52	204	n/a	0	13,342	1,951
Rock Springs	19,458	22,000	13	7,515	6.44	1,249	n/a	140	13,847	11,600

1/ 1979 Per Capita Income adjusted to 1985 dollars with Consumer Price Index.
2/ estimate
3/ 1983

SOURCES:
1980 Population, Permanent Housing:
County and City Data Book, 1983, 10th Edition, U.S. Department of Commerce, Bureau of the Census.
Population 1984:
Various local estimates from county and city planners.
Temporary Housing:
Various personal communications with Chambers of Commerce, city and county planners, local trade associations, American Hotel/Motel Association Hotel/Motel Redbook, 99th annual edition, and state offices of tourism.
RV spaces:
Travel Life, 1985 Campground and Service Directory.
Per Capita Income:
City and County Data Book, 1983, 10th Edition, U.S. Dept. of Commerce, Bureau of the Census.
Employment:
City and County Data Book, 1983, 10th Edition, and various personal communications with local government officials and Chambers of Commerce.

3.1.8.1 Population, Housing, and Economic Characteristics

3.1.8.1.1 Wyoming

The proposed Kern River Project will traverse Lincoln and Uinta Counties in Wyoming. Primary industries in the counties are trade and services. Mining is also relatively significant in these counties. Unemployment is similar to most of the other counties, with around 9 percent of the labor force unemployed. Lincoln and Uinta counties are relatively more with much of the existing infrastructure related to oil and gas development. Therefore, these counties have been hurt economically from the depressed oil and gas prices.

The towns of Evanston in Uinta County, Kemmerer in Lincoln County, and Green River in the adjoining Sweetwater County are profiled in Table 3.1-19. The larger city of Rock Springs in Sweetwater County is also profiled. These are the municipalities that are most likely to be affected by the Kern River proposal. Total temporary accommodations in these three municipalities are 2,873. Occupancy rates in Rock Springs were 62.91 percent in 1984 with an average daily room rate of $36.17 [Pannell, Kerr, Forster, 1984]. Permanent housing units in the four municipalities totalled 15,369 in 1980 with vacancy rates between 6.1 percent in Green River and 11.5 percent in Kemmerer.

3.1.8.1.2 Utah

The Kern River Project and its alternatives traverse 12 counties in Utah. These counties are profiled in the various tables accompanying this section. The total population of the counties in 1980 was 1,314,187 people. The 1984 estimate of population for the counties was 1,483,100 people, implying an average annual growth rate of 3.2 percent.

The 1980 population was contained in 432,358 housing units in these counties, with a vacancy rate of 6.4 percent. Temporary accommodations in these counties totaled 5,710 in 1985. Most of the accommodations are concentrated in Salt Lake County (5,380). There may be motel rooms in smaller towns not in Table 3.1-19.

The average per capita income of the counties was $8,006 in 1983 with Summit County having the highest and Sanpete County with the lowest. The major industries in these counties are trade and services although the industrial composition of several of the counties differ with significant manufacturing sectors.

Public services are generally in sufficient supply in the counties with major populations such as Utah and Salt Lake. In the more rural counties, public service supply per capita is considerably less.

In Table 3.1-19, nine Utah cities are profiled: Brigham City, Cedar City, Heber, Logan, Ogden, Orem, Provo, St. George, and Salt Lake. The largest is Salt Lake City, the state capital, with a 1980 population of 163,033. The number of accommodations in these towns range from very few to a substantial number.

3.1.8.1.3 Nevada

Clark County is noted for being the home of Las Vegas, located in the middle of the county. Clark has a total area of 7,881 square miles and a 1984 population of 536,500, up 15.8 percent from 463,087 in the 1980 Census of Population. The county population has 189,860 housing units available to them. Vacancy rates in the county average 8.4 percent. The number of temporary accommodations in the county (53,600) is much greater than any other comparable county since Las Vegas is a noted tourist draw. A logical question, however, is whether pipeline construction workers are likely to stay at resort hotels.

Clark County's economy is almost entirely based on Las Vegas and therefore is very service oriented (52.96 percent of the 259,723 employees). Per capita personal income was $12,052 in 1983, and total personal income was $6,274.4 million of which $4,252.9 million was wages and salaries.

Public services exist in substantial supply in the county as a result of the tax base created by Las Vegas. No service shortages are anticipated.

In addition to Las Vegas, Henderson may be affected by the proposed project. Both cities are profiled in Table 3.1-19.

Lincoln County is proposed to be traversed by 23 miles of the Kern River Project. The county is profiled in the various tables. Very little population and economic infrastructure exist in the county.

3.1.8.1.4 California

Two California counties are in the study area: San Bernardino and Kern. Kern County is the endpoint for the gas brought in by the proposed pipelines to augment existing production capability. In addition, Bakersfield in Kern County has a considerable existing infrastructure of oil and gas development industry and services.

San Bernardino County is, based on land area, the largest county in California with 20,064 square miles. The 1980 Census reported a population of 895,016 people in San Bernardino County which grew to 1,033,700 people by 1984. Approximately 59.8 of the population is of working age. The county has 366,136 permanent housing units available. A vacancy rate of 15.7 percent exists. Approximately 2,618 hotel and motel rooms are located within 50 miles of the pipeline, most of which are in the Barstow/Victorville area. Vacancy rates for the accommodations in the Barstow area average 50 percent.

San Bernardino County has a fairly strong economy concentrated in trade and services. The total employment in the county was 366,827 in December 1985. Around 0.56 percent is concentrated in agriculture. A major industry in the county is manufacturing with 16.57 percent of the employment. Unemployment in San Bernardino County averaged 8.0 percent in 1984 and declined to 5.9 percent by December 1985. Per capita income was $10,723 in 1983 and total personal income was $10,695.2 million in 1983 of which $4,873.4 was wages and salaries.

Adequate public services generally prevail in areas where population is prevalent. Due to the large size of the county and the relatively small population size in many areas, public service levels are close to nil in many areas. Major population changes in those areas would necessitate capital investments to create and/or augment public services.

The major cities in San Bernardino County that are near the proposed pipeline are Barstow and Victorville with combined 1980 populations of 31,910. The town of Needles may also be affected by the proposed pipelines. Needles had a 1980 population of 4,120. Barstow, Victorville, and Needles are profiled in Table 3.1-19.

Kern County has a land area of 8,130 square miles. The 1980 Census reported that 403,089 people lived in Kern County. By 1984, that number had grown to 462,400 people. Approximately 59.4 percent of the population are of working age, or between 18 and 65. A total of 154,321 housing units are available to permanent Kern County residents and a vacancy rate of 9.4 percent prevails. Approximately 3,253 hotel rooms are within 50 miles of the proposed pipeline routes.

Kern County's industrial strengths relative to other counties are agriculture and petroleum production. Kern County has the highest petroleum output in the country. Of the 200,932 employed people, 1.84 percent work in agriculture and 9.49 percent in petroleum businesses. The majority of remaining employment is in the service (24.39 percent) and trade (30.97 percent) sectors. Per capita personal income was $10,848 in 1983 and total personal income was $4,847.1 million of which $3,040.6 million was in wages and salaries.

In recent years, unemployment has been a problem in Kern County. The 1984 average unemployment rate was 12.2 percent while the December 1985 rate was 10.6 percent. This problem is most likely greater at this point in time, August 1986, due to further unemployment caused by depressed oil and gas prices.

Public services are provided by many different sources in the county and the supplies of these services are generally adequate. Public service shortages were not apparent in the review of existing data and the compilation of primary information for this project.

The major city that the pipeline project(s) will affect will be Bakersfield. Bakersfield's economy relies on the oil and gas industry and the health of the town is driven in large part by the health of the onshore oil fields scattered around Bakersfield and the oil and gas companies with California headquarters in Bakersfield. Bakersfield had a 1980 population of 105,611 with 54,600 people employed. There are 3253 motel rooms and in 553 RV spaces in Bakersfield/Kern area. The average 1985 occupancy rate was 38.0 percent in the Bakersfield area with an average daily room rate of $41.31 [Pannell, Kerr, Forster, 1985]. Table 3.1-19 provides a detailed profile of Bakersfield.

3.1.8.2 Traffic

The proposed project(s) will cross many linear transportation and utility corridors throughout their routes. Included in these crossings are major highways, roads, railroad tracks, canals, aqueducts, pipelines, transmission and telephone lines. The categories in Table 3.1-20 include U.S. interstates, U.S. federal highways, state highways, county/local roads, railroads, and aqueducts.

The roadways crossed by the proposed pipelines are in many cases the same as those adjacent to and used for access by construction, maintenance, and operation personnel. Since information regarding the location of staging areas and permanent operation areas will not be provided prior to award of the contract to construct the pipeline(s), this issue is not addressed in this document.

Because of its length and mixture of urban and rural development, the mainline route of the Kern River proposal has many and varied crossings. The counties traversed by the mainline route and the major crossings are shown in Table 3.1-20. Most of the crossings in Wyoming, Utah, and Nevada are small local roads; not all of these minor crossings were counted. The next most frequently crossed routes are state highways. In Uinta County southeast of Evanston the mainline route at MP 50 crosses the Emigrant (Mormon-California) Trail.

Much of the terrain along the Utah segment is mountainous, and there are many local unimproved roadways and jeep trails to be crossed. Within the Uinta NF, between MP 120.5 and MP 142 at Spanish Fork Canyon, the mainline route runs through terrain where access from any roads is very limited. Between MP 127-131, and 138-141 the land is closed to vehicles of any kind (see Section 3.2.8.4 for recreation opportunity categories). The

Table 3.1-20

TRANSPORTATION CORRIDOR CROSSINGS, KERN RIVER PROPOSAL

State/ County	U.S. Interstate	U.S. Federal	State	County and Local	Railroads 1/	Canals and Aqueducts
WYOMING						
Lincoln and Unita	I-80	US 189	WY 150	6+	UP	-
UTAH						
Summit	-	-	UT 150,35	10+	-	-
Wasatch	I-40	-	-	10+	-	-
Utah	-	US 6/89	-	10+	D&RGW	-
Sanpete	-	-	-	7	-	-
Juab	-	-	UT 132,28	10+	UP(2)	-
Millard	-	US 50	UT 100	30+	UP	-
Beaver	-	-	UT 21	30	-	Low Line Canal
Iron	-	-	UT 56	20	UP	-
Washington	-	-	UT 18	10	-	-
NEVADA						
Lincoln and Clark	I-15(2)	US 93/95	NV 40/189, 167, 41/146	4	-	-
CALIFORNIA						
San Bernardino	-	US 395	CA 127	20+	AT&SF(2)	-
Kern (includes Taft Lateral)	I-5	-	CA 19,99, 58/33	many	SP(3), Sunset, AT&SF	LA, 2nd LA, CA, Arvin Edison Canals
Kern River Lateral	I-5	-	CA 19,99, 58/33	40+	AT&SF,SP	Arvin Edison East Side Canal

---

1/ UP = Union Pacific, D&RGW = Denver and Rio Grande Western, SP = Southern Pacific
AT&SF = Atchison Topeka and Santa Fe
() indicate the number of crossings

existing roads on the National Forest lands are primarily designed, constructed, and maintained for recreational rather than industrial vehicles.

Through Nevada and San Bernardino County, California, the crossings are also mostly small roads. Because of the more urban nature of Kern County, the number and variety of all crossings increase considerably. The Pacific Crest National Scenic Trail is crossed several times because of switchbacks for both the pipeline route and the trail at approximately MP 724.

3.1.8.3 Noise

Ambient noise levels for the pipeline corridor were not measured specifically for this project analysis. Reasonable estimates of the general relationship between population density and existing average day-night noise levels (L_{dn}) reported in one study is shown in Table 3.1-21.

Table 3.1-21

RELATIONSHIP BETWEEN POPULATION DENSITY
AND AVERAGE DAY-NIGHT NOISE LEVELS, KERN RIVER PROPOSAL

Location	Persons/Square Mile	L_{dn} (dBA)
Rural		
Undeveloped	20	35
Partially Developed	60	40
Suburban		
Quiet	200	45
Normal	600	50
Urban		
Normal	2000	55
Noisy	6000	60
Very Noisy	20,000	65

Source: National Research Council [1977]

Projected ambient noise levels in the Kern River project area range from less than 35 dBA to over 65 dBA. This variation in sound level exists because of the variety of land use areas and population regions that the proposed pipeline crosses. Noise levels below L_{dn} of 55 dBA as a maximum sound level typically do not adversely affect public health and welfare by interfering with outdoor activities [EPA, 1974].

The proposed pipeline would pass through generally rural areas of low population density, although some residential, commercial and industrial development does occur along the proposed route.

A recent sound survey of the Northwest Muddy Creek Compressor Station has been completed. These data represent a Solar Centaur Compressor rated at 3730 horsepower. Noise levels ranged from 59 to 94 dBA, the latter resulting from the compressor running at full load close to the compressor building. The nearest noise sensitive area to the Muddy Creek Compressor is a ranch house approximately five miles from the Muddy Creek Compressor Station. The sound level at the ranch was 40 dBA.

3.1.8.4 Recreational Resources

No designated recreational resources are within the mile-wide study corridor in Wyoming.

In northeastern Utah the western boundary of the Wasatch-Cache National Forest is from .5 to approximately three miles east of the proposed route. The developed campground areas are more than four miles east of the corridor. Near MP 111 the corridor enters the Uinta National Forest and continues through Forest Service lands to near MP 139. About .5 mile southeast of the corridor centerline at MP 139 is a designated campground, Palmyra. Palmyra campground has 11 single family sites and four group sites which can accommodate 100 people. These spaces and those in all other Forest Service campgrounds in Utah are not included in Tables 3.1-17 and 4.2-17. There is a 15 day limit for each site; this limit would also apply to pipeline construction workers. While there are no electric, water, or sewage hookups, there are recreational facilities such as horseshoe pits and volley ball areas. Toilet buildings are available but no showers. The roads are paved within the campground. For 1985 the campground recorded 17,000 visitor days. Palmyra is important to the residents within a 100 mile area, and the bulk of its visitors (85 percent) live within a commuting distance of 1.5 hours travel time [Williams, 1986].

One-half mile northwest of the corridor centerline also at MP 139 is Diamond Battle Historic Monument. No designated recreational resources are within the study area throughout central Utah. In the southwestern part of the state the route enters the Dixie National Forest near MP 359 and follows a specified utility corridor.

In addition to and away from developed areas, there is a wide array of dispersed recreational opportunities within Forest Service lands. The most popular activity is driving for pleasure; next in frequency are camping, fishing, hiking, hunting and gathering firewood. Wintertime activities include cross country skiing and snow play. Off-road vehicle use is prohibited in areas off existing travel ways.

Guidelines have been established for managing Forest Service lands so as to provide a variety of recreational opportunities. Six categories covering the range between primitive and urban are defined in terms of setting, experience, evidence of humans, social expectations, and social controls. These categories are Primitive, Semiprimitive Nonmotorized, Semiprimitive Motorized, Roaded Natural, Rural, and Urban. Four of these classes are crossed by the proposed route in the Uinta NF:

MP 113-123	Roaded Natural
MP 123-124	Rural
MP 124-127	Semiprimitive Motorized
MP 127-131	Semiprimitive Nonmotorized
MP 131-133	Roaded Natural
MP 133-138	Semiprimitive Motorized
MP 138-142	Semiprimitive Nonmotorized
MP 142-144	Semiprimitive Motorized
MP 144-146	Semiprimitive Nonmotorized
MP 146-147	Roaded Natural

No designated recreational resources are in the study area throughout the route through the remainder of Utah.

The proposed route crosses portions of and is within .5 mile of the current recreation and public purpose application boundaries of the Valley of Fire State Park in Clark County, Nevada. The land within these proposed boundaries will become state park land the near future [Martin, 1986]. The route comes within .5 mile at approximately MP 449; at MP 450.5 the route begins its parallel traverse with an existing powerline which enters the proposed park boundaries near MP 450.6 and again between MP 452 and 453. At MP 456.5 the route crosses the powerline and runs south; near MP 460 it is immediately adjacent to the proposed western park boundary for the next two miles. Although the route crosses two access roads from U.S. 15 into the park, it does not come within .5 mile of the park trails or use areas.

Between MP 496 and 498.5 the route passes through the proposed Clark County Wetlands Park, an area where recreation activities would include nature study, hiking, and sightseeing in Clark County, Nevada.

Between MP 645-647.5 the mainline route is south of and within .5 mile of the southern boundary of the Rainbow Basin National Natural Landmark, an area of approximately 2,080 acres within Owl Canyon and Rainbow Basin. The area contains fossil beds. Owl Canyon campground is about one mile north of the proposed route. It has 31 sites, a 14-day stay limit, limited water supplies, and an undeveloped overflow area. Although it is open all year, the season of greatest use is between Labor Day and Memorial Day. On holiday weekends and school spring vacation, the campground is usually filled [Rush, 1986].

In Kern County the route crosses the Pacific Crest National Scenic Trail at MP 724 and there is a state highway rest area at MP 686, about four miles west of Boron. The scenic trail is a high mountain trail from Oregon to Mexico used by hikers and horsemen. The segment crossed by the proposed pipeline is on private land, and is administered by the BLM.

Between MP 742-746 the proposed mainline route crosses Stallion Springs, a residential complex. Although the route is in a utility corridor, within the mile-wide analysis corridor are two park sites and a green belt.

No designated recreational sites are in the mile-wide corridor of the Kern River or Taft Laterals.

3.1.9 Land Ownership/Use

Please refer to the introductory paragraphs in Section 3.1.9 of Volume I for a discussion of land ownership entities and land use categories used in this EIR/EIS. Appendix F in Volume II contains a detailed discussion of Forest Service Land and Management Plans in Utah.

The proposed Kern River Natural Gas Pipeline project's mainline routing traverses portions of four states (Wyoming, Utah, Nevada, and California). Within those states it crosses two counties in Wyoming (Lincoln and Uinta), nine counties in Utah (Summit, Wasatch, Utah, Sanpete, Juab, Millard, Beaver, Iron, and Washington), two in Nevada (Lincoln and Clark), and two in California (San Bernardino and Kern). There are several alternative routes being considered: Wasatch Variation, West Strawberry, Salt Creek Canyon, North Las Vegas, Henderson, North Bakersfield, and two laterals, Taft and Kern River. The Wasatch Variation would add three counties: Morgan, Davis, and Salt Lake in Utah. In addition, there are three system alternatives: East Las Vegas/Integrated Intrastate, East Las Vegas Alternative with the Wasatch Variation, and Northwest/PGI/Integrated Intrastate.

Land ownership by county is shown in Table 3.1-22. Table 3.1-23 shows the land use by county and Table 3.1-24 shows the rules, regulations and policies of the administrative agencies.

3.1.9.1 Mainline

In Lincoln County, Wyoming (MP 0-12.9) the existing land use is all grazing. Lincoln County has a planning program and Official zone map. Natural gas pipelines are considered a conditional use and a Developer's Packet provided by the county details the steps and applications that must be adhered to before construction can take place.

Table 3.1-22

LAND OWNERSHIP, KERN RIVER PROPOSAL

Name	County, State	Total	Private Miles	Private %	BLM Miles	BLM %	State Miles	State %	FS Miles	FS %	DOD Miles	DOD %
Mainline	Lincoln, WY	12.9	6.2	(48)	6.1	(47)	0.6	(5)	-		-	
	Uinta, WY	49.5	35.2	(71)	11.9	(24)	2.4	(5)	-		-	
	Summit, UT	36.4	36.4	(100)	-		-		-		-	
	Wasatch, UT	25.2	15.9	(63)	-		-		9.3	(37)	-	
	Utah, UT	38.5	19.1	(50)	-		1.0	(2)	18.4	(48)	-	
	Sanpete, UT	5.7	4.7	(82)	-		1.0	(18)	-		-	
	Juab, UT	45.0	37.8	(84)	6.5	(14)	0.7	(2)	-		-	
	Millard, UT	64.5	44.3	(69)	17.9	(28)	2.3	(3)	-		-	
	Beaver, UT	33.8	5.9	(17)	26.3	(78)	1.6	(5)	-		-	
	Iron, UT	48.8	23.9	(49)	20.8	(43)	3.7	(8)	0.4	(1)	-	
	Washington, UT	48.3	3.0	(6)	25.0	(52)	2.7	(6)	17.6	(36)	-	
	Lincoln, NV	23.0	-		23.0	(100)	-		-		-	
	Clark, NV	108.0	17.0	(16)	91.0	(84)	-		-		-	
	San Bernardino, CA	135.4	33.0	(24)	100.0	(74)	1.4	(1)	-		1.0	(1)
	Kern, CA	81.1	79.4	(98)	1.7	(2)	-		-		-	
TOTAL MAINLINE WITHOUT LATERALS		755.7	361.3	(48)	331.2	(44)	17.4	(2)	45.7	(6)	-	
Taft Lateral	Kern, CA	48.0	42.9	(89)	2.0	(4)	-		-		3.1	(7)
Kern River Lateral	Kern, CA	27.0	27.0	(100)	-		-		-		-	
TOTAL WITH LATERALS		831.1	431.7	(52)	332.2	(40)	17.4	(2)	45.7	(5)	4.1	(1)

Table 3.1-23

LAND USE, KERN RIVER PROPOSAL

Name	County, State	Total Miles Traversed	Grazing/ Rangeland Miles	%	Timber/ Forestland Miles	%	Irrigated/ Non-Irrigated Agriculture Miles	%	Residential Miles	%	Other Miles	%
Mainline	Lincoln, WY	12.9	12.9	(100)	-		-		-		-	
	Uinta, WY	49.5	49.5	(100)	-		-		-		-	
	Summit, UT	36.4	33.4	(92)	-		3.0	(8)	-		-	
	Wasatch, UT	25.2	15.9	(63)	9.3	(37)	-		-		-	
	Utah, UT	38.5	19.1	(50)	19.4	(50)	-		-		-	
	Sanpete, UT	5.7	5.7	(100)	-		-		-		-	
	Juab, UT	45.0	30.5	(68)	-		14.5	(32)	-		-	
	Millard, UT	64.5	59.5	(92)	-		5.0	(8)	-		-	
	Beaver, UT	33.8	31.4	(93)	-		2.4	(7)	-		-	
	Iron, UT	48.8	48.8	(100)	-		-		-		-	
	Washington, UT	48.3	30.7	(64)	17.6	(36)	-		-		-	
	Lincoln, NV	23.0	23.0	(100)	-		-		-		-	
	Clark, NV	108.0	76.0	(70)	-		1.0	(1)	19.0	(18)	12.0 1/	(11)
	San Bernardino, CA	135.4	130.4	(96)	-		2.0	(2)	3.0	(2)	-	
	Kern, CA	81.1	52.1	(64)	-		23.0	(28)	6.0	(8)	-	
TOTAL		756.1	618.9	(82)	46.3	(6)	50.9	(7)	28.0	(4)	12.0	(2)
Taft Lateral	Kern, CA	48.0	23.5	(48)	-		21.5	(45)	-		3.0 2/	(6)
Kern River Lateral	Kern, CA	27.0	12.0	(46)	-		9.0	(32)	6.0	(22)	-	
TOTAL WITH LATERALS		831.1	654.4	(79)	46.3	(5)	81.4	(10)	34.0	(4)	15.0	(2)

1/ recreation   2/ Elk Hills Naval Petroleum Reserve

Table 3.1-24

FEDERAL, STATE, AND COUNTY LAND USE REGULATIONS AND POLICIES, KERN RIVER PROPOSAL

Administrative Agency	Document	Policies/Requirements
Federal		
Department of Interior Bureau of Land Management		locate in designated utility corridors
Kemmerer District, WY	Resource Management Plan	not within corridor but not subject to the corridor concept
Salt Lake District, UT	Resource Management Plan	within utility corridors
Richfield District, UT	Resource Management Plan	within utility corridors
Cedar City District, UT	Resource Management Plan	within utility corridors
Las Vegas District, NV	Management Framework Plan	no designated utility corridor in Clark County, partially within deisgnated utility corrtidor in Lincoln County
California Desert District	California Desert Conservation Area Plan	within utility corridors
Bakersfield District, CA	Resource Management Plan	no designated corridors
Department of Agriculture U.S. Forest Service		locate in designated utility corridors
Uinta Forest	Land and Resource Management Plan	not within designated utility corridor
Wasatch-Cache Forest	Land and Resource Management Plan	not within designated utility corridor
Manti-La Sal Forest	Land and Resource Management Plan	not within designated utility corridor, within a designated avoidance area
Dixie Forest	Land and Resource Management Plan	within utility window
Department of Defense		
Camp Williams	letter of concerns	permission from Corps of Engineers, Sacramento District, and State Armory Board (Utah) and Utah National Guard
Fort Irwin		apply for permit
Moapa Indian Reservation		State BLM grants ROW clearance
Nellis Air Force Base	letter of concerns	need letter requesting easement; submit AF Form 813
Elk Hills NPR		consultation with administrators

Table 3.1-24 (continued)

FEDERAL, STATE, AND COUNTY LAND USE REGULATIONS AND POLICIES, KERN RIVER PROPOSAL

Administrative Agency	Document	Policies/Requirements
State		
Wyoming		no identified land use regulations concerning interstate pipelines
Utah	Rules and Regulations Governing the Issuance of Right of Way and Right of Entry, 1982	apply for permit
Nevada	no published rules and regulations	
California	no published rules and regulations	
County		
Lincoln, WY	Developers Pocket and Planning Program	apply for conditional use permit
Uinta, WY	Comprehensive Plan, 1984; Land Use Resolution, 1981; Planning Area Index	apply for conditional use permit
Summit, UT	Summit County Master Plan, 1978	permitted use in all zones but must conform to standard building code requirements
Wasatch, UT	Comprehensive Plan, 1973	submit plans to planning commission
Utah, UT	Master Plan, 1980 and Zoning Ordinances, 1984	submit plans to planning commission
Sanpete, UT	Development Code, 1981	apply for conditional use permit, notify abutting property owners
Juab, UT	Ordinances, 1977	apply for permit
Millard, UT	Comprehensive Development Plan and Zoning Ordinances	apply for conditional use permit
Beaver, UT	Chapter 14, Multiple Use District	apply for conditional use permit
Iron, UT	Land Management Code of 1981	apply for conditional use permit
Washington, UT	Master Plan	apply for permit
Salt Lake, UT	Salt Lake County Master Plan, Land Use Element	no reference to pipelines
Lincoln, NV	no published plans	
Clark, NV	Comprehensive Plan	apply for permits

Table 3.1-24 (continued)

FEDERAL, STATE, AND COUNTY LAND USE REGULATIONS AND POLICIES, KERN RIVER PROPOSAL

Administrative Agency	Document	Policies/Requirements
County (continued)		
San Bernardino, CA	San Bernardino County, Consolidated General Plan and Implementation System (includes amendments to March 10, 1986)	promote consolidation of new pipelines and existing pipelines... except where there are demonstrated concerns
Kern, CA	Kern County Zoning Ordinance, 1986	no reference to pipelines
City		
Nephi, UT	Zoning Ordinances, 1984	apply for permit
Las Vegas, NV	General Plan, 1985; Community Profiles, 1985	plan and coordinated utility installation and street construction with the utility companies to minimize costs and create less disruption to public
Henderson, NV	Comprehensive Plan, 1985; Land Use Map; Planning and Zoning, 1984; Zoning Map	apply for permit
Barstow, CA	General Plan Map; Zoning Map	coordinate with city managers
Bakersfield, CA	Land Use and Circulation Map; Title A Zoning, 1985	coordinate with city planners

The land in Uinta County, Wyoming (MP 12.9-64.4) is used for livestock grazing. Uinta County has a comprehensive plan whose goal is: "Power, communication, natural gas and other utility facilities should be located and coordinated in a manner that will help to preserve the natural and man-made environment."

The rugged mountain terrain in Summit County, Utah (MP 62.4-98.8) is used for grazing. In the Kamas Valley there is some agriculture (grass hay, pasture hay, and alfalfa) but the pipeline is not projected to cross any perennial cropland. It is within 0.5 mile of the town of Kamas. Summit County's Master Plan states the "new construction should be sound and conform with standard building code requirements." Natural gas pipelines are a permitted use in all the zones which apply to the proposed route.

In Wasatch County, Utah (MP 98.8-124) the pipeline is proposed to pass through 9.3 miles of Uinta National Forest land but not within a designated utility corridor. Existing land use is forest and grazing. The pipeline passes through Forestry and Watershed Conservation Zones of Wasatch County which are subject to review and approval of the Planning Commission.

Nearly half of the land in Utah County, Utah (MP 124.0-162.5) is National Forest System land administered by Uinta National Forest; the pipeline is not in a designated utility corridor. Utah County's Master Plan and Zoning Ordinances specify steps to be taken before construction. Within 0.5 mile near MP 139 are a campground and the unincorporated villages of Birdseye and Pines.

The existing land use in the portions of Sanpete County, Utah (MP 162.5-168.2) that the pipeline traverses is grazing. The area is zoned grazing-agricultural and natural gas pipelines are considered a conditional use.

In Juab County, Utah (MP 168.2-213.1) Kern River proposes to pass through part of Salt Creek Canyon; farther south it goes into Juab Valley, where the zoning is rural residential. Chicken Creek Reservoir is within 0.5 mile of the proposed route. All BLM and State lands are leased for grazing. The ordinances of Juab County do not specifically address natural gas pipelines. BLM's House Range Resource Area Draft EIS states that "corridors would be designated along existing rights of way (ROW). Major new ROW would be directed to locate within these corridors when feasible." Kern River's mainline is not within an existing corridor. The land use is grazing.

Millard County's (MP 213.1-277.6) Comprehensive Plan and Zoning Ordinances specify that the zones involved in the proposed route are range and forest, agriculture, forest, and recreation. Natural gas pipelines are allowed in these zones as a conditional use. The area around Holden, an unincorporated village, is zoned for agriculture; the pipeline route is within this area. Around

Scipio Pass the pipeline enters the Warm Springs Resource Area whose policy is that "whenever possible new long distance rights of way be restricted to major existing corridors in the planning area." Kern River's Mainline is not within an existing corridor. The predominant land use is grazing.

Beaver County's (MP 277.6-311.4) zoning ordinance considers natural gas pipelines as a conditional use in zoned multiple-use districts. The predominant land use is grazing except in the southern end of the Escalante Desert, northwest of Minersville where it will traverse approximately two miles of irrigated cropland.

In Iron County (MP 311.4-360.2) the land use is grazing until approximately MP 330. The mainline is not in the IPP California System Preferred Route that the Cedar-Beaver-Garfield-Antimony Resource Management Plan has designated as a utility corridor. It passes within 0.5 mile of the small village of Newcastle and through a gravel pit east of Newcastle.

The mainline enters the Dixie National Forest at the Washington County border (MP 360.2-408.5). The pipeline route is in the Newcastle-to-Veyo Utility Corridor. The land use is grazing.

The land use in Lincoln County, Nevada (MP 408.5-431.5) is all BLM controlled and the land use is grazing. The Caliente Resource Area has designated utility corridors. The mainline is outside the corridor between the Lincoln County line to MP 419; from there to the Clark County line, it is inside the corridor.

The proposed mainline then enters Clark County, Nevada (MP 431.5-539.3). Between MP 438-440 is SCS-designated prime farmland. In the Moapa Valley it passes across one mile of irrigated agricultural land, and then skirts the edge of the Moapa Indian Reservation for four miles. Between MP 464 and MP 473 the pipeline crosses approximately eight miles of SCS-designated prime farmland. It traverses the BLM designated Sunrise Mountain Instant Study Area. The Nevada BLM Resource areas have no designated utility corridors. From approximately MP 489 to 496.5, the area is used for recreation. It crosses approximately 1.5 miles of the proposed Clark County Wetlands Park. The overall goal of the park is "to protect, conserve, enhance and maintain the natural scenic, historical, economic, and recreational qualities of land along the Las Vegas Wash" [Master Plan, 1982]. From MP 496.5 to 515.6 the land use is residential. The mainline traverses East Las Vegas going through areas zoned commercial and residential. It is proposed to pass through 10 miles within the city limits of Henderson. Zoned areas crossed are industrial district, rural residential, one family residence, limited multi-residential district, general commercial, apartment residences, civic district, and ranch estates. From MP 515.6 to the Nevada/California boundary the land use is grazing.

As the proposed pipeline moves into San Bernardino County, (MP 539.3-674.6) California, it goes into Corridor D designated by the BLM's California Desert Conservation Area (CDCA). This corridor has four major existing transmission lines and the land use is ephemeral grazing. On the south from approximately MP 545.2-565.2 is the East Mojave National Scenic Area. This area is being proposed by Senator Cranston as a national park. It is within 0.5 mile around MP 547 of Clark Mountain Area of Critical Environmental Concern (ACEC). Table 3.1-25 shows the WSAs bordering the proposed route.

Table 3.1-25

WILDERNESS STUDY AREAS, KERN RIVER PROPOSAL

Name	Milepost	Direction From Pipeline
Stateline	538-543	north
Mesquite Mountains	543-553	north
Kingston Range	557-565	north
Hollow Hills	577.5-580	south
Silurian Valley	576-580	north
Avawatz Mountains	584-585	north
South Avawatz Mts.	586-597	north
Soda Mountains	584-610	south

At approximately MP 619.5 the pipeline goes from Corridor D to Corridor Q as designated by the CDCA. Fort Irwin is within 0.0 to 0.5 mile of the proposed route from MP 594 to 611. Between MP 645-647.5 the mainline route passes south of and within .5 mile of the southern boundary of the Rainbow Basin Area of Critical Environmental Concern. The approximately 4,000 acre area encompasses major portions of fossil beds in Mud Hills. The pipeline is proposed to pass through approximately two miles of SCS-designated prime farmland between MP 656-667. Around Kramer Junction the pipeline goes into Corridor G which skirts the northern edge of Edwards Air Force Base for approximately 0.5 mile and is within 0.5 mile of the city of Boron. San Bernardino County's Comprehensive Plan has not been published as of this date but the county participated in the development of the Joint Utilities Management Program (JUMP) which was published in 1976.

This document was designed to serve "as a policy document for the Board of Supervisors, the Planning Commission, the State Energy Commission, the BLM, other governmental and private agencies and individuals on all major energy related issues in San Bernardino County" [JUMP, 1976]. Its major policy statement regarding new pipeline corridors is that they "should be consolidated within existing pipeline or electrical transmission corridors except where there are social, aesthetic, significant economic or other overriding concerns" [JUMP, 1976].

In Kern County, (MP 674.6-755.7) the proposed routing borders the north property line of Edwards Air Force Base between MP 688-703. The line originally traversed about 200 feet of the base but the route was subsequently modified to avoid Edwards Air Force Base entirely. It passes through about four miles of SCS identified prime farmland between MP 684-689. It also traverses a quarter section of BLM land south of North Edwards that is leased residential, and crosses about three miles of prime farm-land between MP 695-700, one half mile at MP 709 and approxi-mately one mile between MP 716-721. It also crosses approximately seven miles of prime farmland between MP 728.5-741.0. It is proposed to traverse within 0.5 mile of the California Correctional Institute. Kern River proposes to build the pipeline through the residential development of Stallion Springs within an existing utility corridor. Between MP 739-746 the pipeline traverses El Tejon Ranch. The mainline would pass through about six miles of orchards and vineyards between MP 750-756. At MP 756 the Kern River bifurcates into the Taft and Kern River Laterals.

Kern River Compressor Station No. 1, in Lincoln County, Wyoming, is located on private land used for grazing. Compressor Station No. 3, in Millard County, Utah, is located on BLM land; the land use is grazing. Compressor Station No. 5, in Clark County, Nevada, is located on private land also used for grazing.

3.1.9.2 Kern River Lateral

The entire Kern River Lateral is located on private land in Kern County, California. Of the 27 proposed miles, 8.5 miles are being used for orchards or vineyards. The town of Lamont is within 0.0 to 0.5 mile of the proposed route between MP 11-13. From MF 11.5-18.5 the proposed route is located within the Atchison, Topeka and Santa Fe Railroad's ROW. From MP 20-24 it is within the city limits of Bakersfield. This area is zoned R-1 (single family residential). Bakersfield has no identified references to pipelines passing through this R-1 area but oil and gas drilling is a permitted use within the zone.

3.1.9.3 Taft Lateral

The proposed Taft Lateral traverses approximately 47 miles in Kern County, California. The first mile of its western journey goes through orchards and vineyards. It crosses private land until it reaches the California Aqueduct, then parallels the aqueduct for about one mile before entering the Elk Hills Naval Petroleum Reserve (Elk Hills) for the rest of its length. Elk Hills uses the guidelines developed by the USFWS. This area, whether the pipeline is traversing private, BLM, or DOD land, includes grazing and oil field activities. It terminates approximately one mile northwest of the village of McKittrick.

3.1.10 Cultural Resources

3.1.10.1 Archaeology

The cultural resource data for the Kern River gas pipeline project areas were compiled from existing environmental analyses, technical reports and cultural resource inventories prepared for sections of the proposed pipeline route as well as for similar, adjacent and parallel pipeline and electric transmission line projects, such as the Rocky Mountain Pipeline Project, the Intermountain Power Project, the All American Pipeline Project, and the Mead/McCullough-Victorville/Adelanto Transmission Project. In cases where such reports contained insufficient or outdated site and survey data for a given corridor, coverage was expanded and brought up to date. For those sections lacking documentation, a complete Class I inventory was implemented for the mile-wide pipeline corridor.

In order to update previously existing inventories of cultural resources and to prepare new ones for undocumented pipeline segments, the records of the various regional clearinghouses, SHPOs, BLM offices, and Forest Service offices for areas along the project corridors were consulted.

The cultural resources situated in the mile-wide corridor are presented in Tables 3.1-26 and 3.1-27 which summarize numbers of sites, their National Register status, and data on site types. The data in these tables reflect the information available as of April 1986. In most instances, only a small portion of the route has been the subject of ground surveys performed to BLM standards and, as such, there are large gaps in the data. Exceptions to this include the site data resulting from surveys of the Intermountain Power Project and the Mead/McCullough-Victorville/Adelanto transmission line ROWs as well as the intensive survey done along the Celeron/All American Pipeline construction ROW. The fact that some pipeline segments contain few sites frequently reflects the general lack of research in the area. Prior to actual pipeline construction, a decision will be made in conjunction with appropriate federal and state officials regarding those locations where it will be necessary to conduct intensive on-the-ground surveys to ascertain the full extent of cultural resources present in the actual construction corridors. Please note that the tables in this section summarize the known cultural resources within the mile-wide corridors. A discussion of those sites within the proposed project construction ROWs is presented in the impact section.

National Register status in Table 3.1-26 refers only to the result of official determinations. Many other sites may meet the eligibility criteria but have not been formally evaluated. Also note that six sites are listed on state registers or are state monuments: one in Wyoming, one in Utah, one in Nevada, and three in California. In addition, another site is listed in the California Inventory of Historic Resources.

In Wyoming, the site listed on the NRHP refers to the California Emigrant Trail. This trail would qualify for NRHP status if the trail has integrity where it is crossed by the pipeline corridor. In Utah, this figure refers to the Mountain Meadows Historic Site area including the historical monument. There are 15 known prehistoric sites in the analysis corridor that are situated within the boundaries of this large historic site.

The tables summarizing and interpreting the cultural resources for the Kern River project are based on the data presented in some detail in the cultural resources technical report. Details on past survey coverage and an overview of the prehistory, history and ethnohistory of the project area are also contained in the technical report. To protect cultural resource localities from unauthorized collecting, this report will be made available only to qualified investigators.

Table 3.1-26

KNOWN CULTURAL RESOURCE SITES, KERN RIVER PROPOSAL

	Sites and National Register Status			
Pipeline Segment and State	Listed on NRHP	Determined Eligible/ Nominated	Determined Ineligible	Undetermined
Kern Mainline				
Wyoming	1	4/0	31	59
Utah	1	0/2	0	224
Nevada	0	1/0	0	63
California	1	1/0	0	146
Kern River Lateral				
California	0	0	0	3
Taft Lateral				
California	0	0	0	9
Total Sites	3	6/2	31	504

Table 3.1-27

KNOWN CULTURAL RESOURCE TYPES, KERN RIVER PROPOSAL

	Pipeline Segments					
	Mainline (by state)				Kern River	Taft
Type	WY	UT	NV	CA	Lateral	Lateral
Habitation	20	1	-	-	-	-
Habitation+Bedrock Mortars	-	-	-	-	4	-
Campsite	9	7	-	6(14)	-	-
Camp+Bedrock Mortars	-	-	-	7	-	-
Scatters						
Lithic	28	162	13	65	-	2
Ceramic	(2)	-	2	-	-	-
Groundstone	1	-	-	(1)	-	-
Lithic+Ceramic	-	8(2)	2	-	-	-
Lithic+Groundstone	-	3	-	2	-	-
Lithic+Ceramic+ Groundstone	-	2	-	-	-	-
Lithic+Fire altered rock	-	-	-	6(2)	-	-
Features						
Bedrock Mortar(s)	-	-	-	10	-	-
Bedrock Mortars+ Lithics	-	-	-	4(1)	-	-
Milling	1	-	-	8(1)	-	-
Structure	-	1	-	-	-	-
Mound	-	1	-	-	-	-
Midden	-	-	(4)	(2)	-	-
Roasting Pit	-	1	2	-	-	-
Hearth(s)	4	-	-	1(1)	-	3
Hearth+Lithics	7	-	-	-	-	-
Cave	-	1	4	-	-	-
Rockshelter	-	6	10	7	-	-
Quarry	6	9	-	7	-	-
Trail	-	-	-	1	-	-
Burial/Cemetery	-	-	1	-	-	-
Petroglyphs	-	(2)	-	(1)	-	-
Rock Ring	-	-	4(1)	1	-	-
Rock Ring+Lithics	-	-	8	-	-	-
Tipi Ring	3	-	-	-	-	-
Cairn	1	-	-	1	-	-
Granaries	-	2	-	-	-	-
Rock Feature	-	-	-	2	-	-
Isolated Finds	-	-	9	5	-	-

Table 3.1-27 (continued)

KNOWN CULTURAL RESOURCE TYPES, KERN RIVER PROPOSAL

	Pipeline Segments					
	Mainline (by state)				Kern River	Taft
Type	WY	UT	NV	CA	Lateral	Lateral
Historic Features						
Historic Site	7	1	-	1	-	-
Historic Camp	1	-	-	1	-	-
Historic Trash	2	5(1)	3	1(2)	1	2
Historic Dump	-	4(1)	1	(1)	-	-
Bridge	-	2	-	-	-	-
Mining site	-	-	-	2	-	-
Homestead	-	1	-	-	-	1
Ranch	1	2	-	-	-	-
Shelter	-	(1)	(3)	-	-	-
Historic Grave	-	-	-	1	-	-
Cemetery	-	1	-	-	-	1
Adobe	-	-	-	1	-	-
Ferry	-	-	-	-	1	-
Oil Well	-	-	-	-	1	-
Wagon	-	1	-	-	-	-
Railroad Camp	-	-	2	-	-	-
RR -"Last Spike"	-	-	1	-	-	-
Historic Hearth	-	-	-	1	-	-
Historic Trail	2	1	-	-	-	-
Pass	-	-	-	1	-	-
Road	-	1	-	-	-	-
Cutoff	1	-	-	-	-	-
Railroad Grade	-	-	1	-	-	-
Railroad	1	-	-	1	-	-
Historic Town	-	1	-	-	-	-
Telephone Line	-	-	1	-	-	-
Historical District	-	1	-	-	-	-
Historical Monument	-	1	-	-	-	-
Unknown	-	1	-	2	-	-
Total Sites	95	227	64	148	3	9

Figures in parentheses refer to additional instances occurring at sites which have already been counted once in the table.

Summary. The Kern River mainline plus its two laterals represent about 831 miles of pipeline. Close to 190 surveys have been conducted within or partially within the analysis corridor. These surveys covered approximately 41.65 miles (5.0 percent) of construction ROW. Another 258 miles of survey were directly adjacent to (perhaps partially covering) the ROW. A total of 546 sites have been documented within the analysis corridors. These include 480 prehistoric sites, 63 historic sites, and three sites of unknown time period. Three sites are listed on the National Register, six have been determined to be eligible, and two have been nominated to the register. Thirty-one sites have been officially determined to be ineligible. In addition, six sites are listed on state registers or are state monuments: one in Wyoming, one in Utah, one in Nevada, and three in California. Another site is listed in the California Inventory of Historic Resources.

Proposed New Compressor and Microwave Stations. No sites have been documented within the areas proposed for these stations and no surveys have been conducted.

Site Significance. Aside from the sites which have National Register status, it is not possible at this time to make a formal assessment of the significance of sites found within the analysis corridor. In practice, both Appendix K in CEQA and NHPA (Section 106) procedures generally require formal subsurface testing in order to properly assess site significance. Since such testing has not been conducted on the vast majority of known sites, it will be assumed that all sites are potentially significant until further investigation proves otherwise. Only sites which have been officially determined to be ineligible for the National Register or which have been destroyed are viewed as insignificant.

Route Sensitivity Ratings. While an inventory of the known cultural resources provides important data for an assessment of potential impacts (see Chapter 4) it does not provide adequate data for a comparison of route variations to their equivalent mainline segments or for comparisons between the various pipeline proposals. This is because in most instances only a small percentage of the proposed construction ROWs have been surveyed for cultural resources (frequently less than 10 to 15 percent) and the percentage surveyed differs in each case. In view of this situation, it is necessary to make an estimate of the potential for cultural resources along the route. Pipeline routes must be evaluated in terms of their sensitivity for cultural resources. Because of incomplete and differential survey data, route comparisons can only be realistically made using such sensitivity ratings.

To accomplish this, pipeline routes were broken into 25-mile segments. (Segments were shorter in cases where proposed routes were less than 25 miles, e.g., the Mojave Transfer Line; and they were sometimes a few miles longer to avoid residual segments of only a few miles.) Each segment was assigned a sensitivity rating of "very high", "high", "moderate", "low", or "uncertain". These ratings were based on four kinds of data: 1) estimated site densities within the analysis corridor as determined from previous survey data, 2) the presence of sites (or districts) with National or State Register status, 3) the crossing of Indian reservation lands, and 4) elementary terrain analysis (e.g., the presence of major water sources). In instances where there was insufficient survey coverage of the analysis corridor to justify making an estimate of site density, a segment was assigned a rating of uncertain. The details of how rating assignments were made are provided in the Cultural Resources Technical Report.

Only "very high" and "high" sensitivity segments were utilized as a basis for the comparison of routes and variations (see Volume III). When these occur along a given pipeline route or variation, this will be indicated. There are two very high and seven high sensitivity pipeline segments along this route. All of these lie along the Kern mainline except for one high sensitivty segment along the Kern Lateral.

3.1.10.2 American Indian Concerns

In order to document such concerns, a letter explaining the proposed project was sent with appropriate route maps to appropriate Indian groups and individuals. The letter specifically requested responses with regard to sacred areas, archaeological sites and their excavation, burials, and ethnographic use areas with particular reference to traditional plants and animals. When groups responded, follow-up telephone or written contacts were made. A copy of the initial letter and the list of those contacted are provided in the cultural resources technical report. In addition, existing published documentation on American Indian concerns was consulted whenever it dealt with the area of the proposed project.

Since the Moapa Indian Reservation (Nevada) lies partially within the mile-wide analysis corridor of the proposed mainline route and because it is crossed by the proposed North Las Vegas Variation, a presentation was made before the tribal council in Moapa (NV) and informal interviews were conducted with several individuals.

The Moapa River Indians expressed considerable concern about any pipelines which would cross their tribal lands, such as the North Las Vegas Variation. Although the Kern River mainline does not cross reservation land, a portion of the reservation does lie within the mile-wide analysis corridor. Their general concerns include those for systems safety, harm to ancestral sites, sacred areas (including burials) and traditional use areas, erosion of tribal lands due to the effects of pipeline construction and the cutting of access roads, and possible land use conflicts since the tribe has plans to lease recently acquired lands to ordnance manufacturers. In general, the Moapa River Indians are not convinced that anyone will listen to their concerns because of their past experience with the Intermountain Power Project whose transmission lines were ultimately built across their lands within a previously designated BLM utility corridor.

Previous studies of Moapa River Indian concerns regarding the Intermountain Power Project transmission lines [Stoffle and Dobyns, 1982; 181-195; Stoffle et al., 1983; 141-147] have shown that traditional ethnographic use areas are of the utmost concern. Most of these areas, such as the Arrow Canyon Range and Valley, are situated well to the north of the proposed Kern River mainline. Two areas, Halfway Wash and the Moapa River (Muddy River) Valley, are crossed by the proposed pipeline. This study also showed that springs, religious sites, burial sites and trail shrines were among the most sensitive areas, and that the desert tortoise and mountain sheep were the most sensitive animal species. Details on specific plant species of concern to the Moapa are presented in Stoffle and Dobyns [1982; 188-193] and Stoffle et al. [1983; 146-147].

The above studies also dealt with the concerns of other Southern Paiute groups, including the Las Vegas and Pahrump Tribal groups of southern Nevada, the Paiute Indian Tribe of Utah (Koosharem, Kanosh, Indian Peaks, Cedar City, and Shivwits groups), and the Kaibab Paiute Tribe of Arizona. These studies revealed that a number of traditional ethnographic use areas that are sensitive to the Southern Paiute are situated along the Kern River mainline route which parallels the Intermountain Power Project from near Avon, Utah, to just north of the Moapa Valley. Areas which are particularly sensitive to most Southern Paiute groups include Hamblin Spring, Pinto Creek, Jackson Spring, Hyatt Spring, Sand Spring Canyon, Beaver Dam Wash, Mountain Meadows, Cottonwood Wash, Pahcoon Spring Wash, Rods Spring, Manganese Wash, Cactus Flat, Meadow Valley Wash, Davidson Peak, and the Muddy River [Stoffle et al., 1983; 94-95]. Except for the last two which are situated in Nevada, most of these sites are located in Utah between MP 350-405 of the Kern River mainline. Further south in Nevada, other areas noted as sensitive along the Kern River mainline include the California Wash, Las Vegas Wash, and Gypsum Cave.

In addition, other areas not mentioned above are particularly sensitive to certain Southern Paiute groups. Of particular interest to the Shivwits Paiute is a sacred cave located in the general vicinity of the Kern River mainline and the Shivwits Indian Reservation in southern Utah [Stoffle et al., 1983; 115]. The Las Vegas and Pahrump tribal groups expressed concern for the following ethnographic use areas which are traversed by the Kern River mainline or lie within the mile-wide analysis corridor: the Frenchman Mountains, Ivanpah Lake, Ivanpah Valley, and the McCullough Mountains in southern Nevada and the Clark Mountains just across the border in California [Stoffle and Dobyns 1982;

167-168]. The Clark Mountains are also considered sensitive by the Cedar City and Indian Peak groups of Utah.

In terms of types of cultural resource sites or areas, the Southern Paiute as a group ranked burial sites to be of most concern, followed by springs, religious sites, areas containing traditional plants used for food, medicine and baskets, large game animals, and trails and trail shrines [Stoffle et al., 1983; 92]. More detailed information regarding specific plant and animal species are provided in Stoffle and Dobyns [1982] and in Stoffle et al [1983].

The Ute Indian Tribe (Ute Tribal Museum, Fort Duchesne, Utah) stressed that the Ute used to live in part of southwestern Wyoming and in all of eastern Utah and are thus concerned about archaeological sites and their contents, burials, and traditionally used plant and animal species within the analysis corridor of the Kern River pipeline in Wyoming and northeastern Utah.

Finally, a representative of American Indians living in the Tehachapi Mountains of California expressed concern for ancestral (archaeological) sites and burials.

The American Indian Council of Central California expressed concern about ancestral sites and burials along the Kern River.

3.1.11 Paleontological Resources

See Section 3.1.11 of Volume I for a discussion of methods, information sources, and importance criteria. Table 3.1-28 identifies the significant formations along the Kern River route corridor.

3.1.12 Visual Resources

The scenic environment of the study area includes Wyoming, Utah, Nevada, and California. The Wyoming scenic environment is generally characteristic of the subalpine and coniferous forest vegetation types with areas of aspens and oak-maples. The landforms consist of steep mountain peaks, ridgelines, and foothill transition areas.

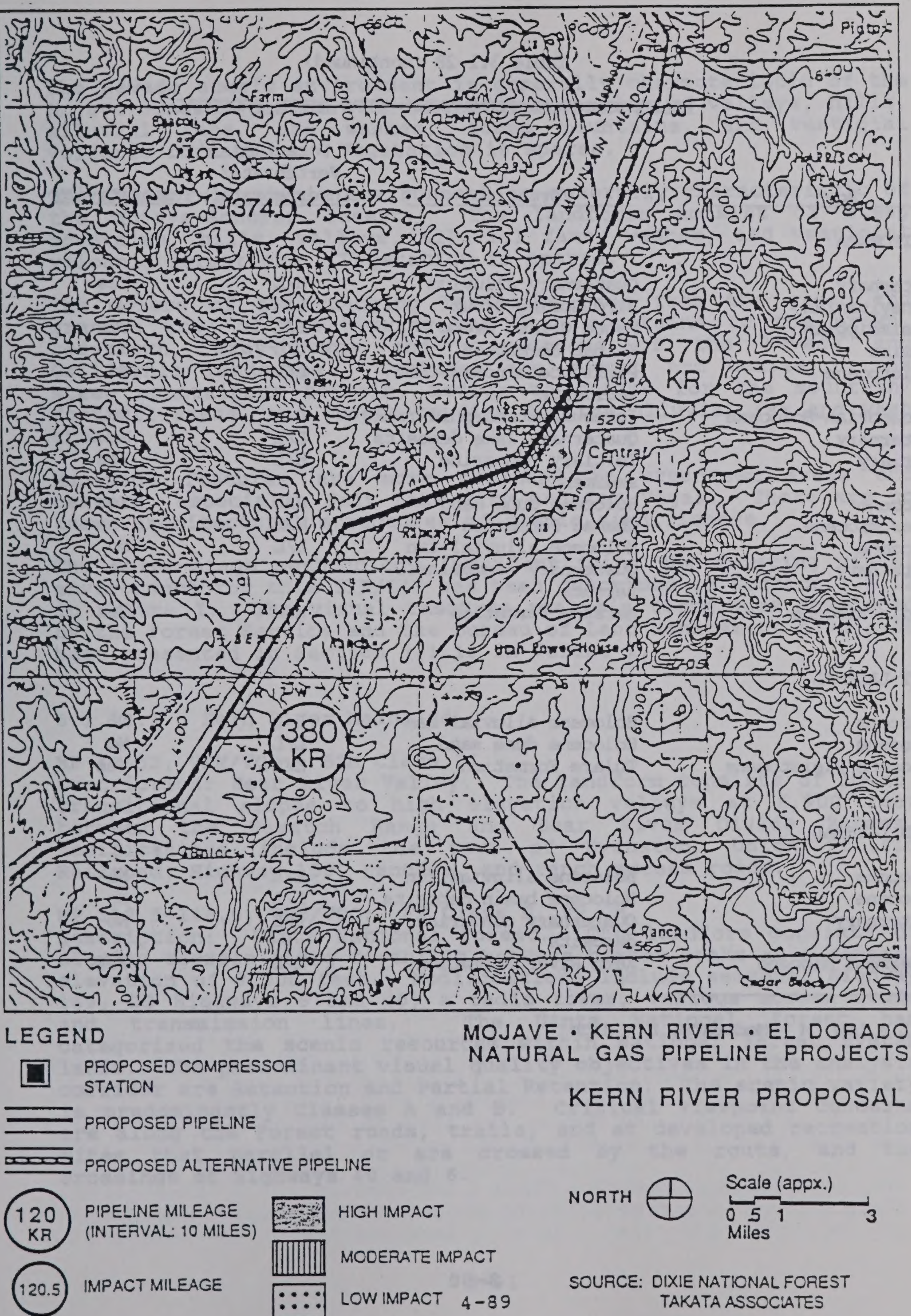
The Utah scenic environment is generally characteristic of subalpine and coniferous forest vegetation types with areas of aspens and oak-maples. The landforms are characteristically steep mountain peaks or domes, rock outcrops, vertical or near vertical cliffs, deep canyons, foothills, and the Great Salt Lake.

Table 3.1-28

PALEONTOLOGICAL FORMATIONS, KERN RIVER PROPOSAL

Age	Formation	Potential 1/ Vertebrate/ Invertebrate	Sensitivity
WYOMING			
Eocene	Bridger Formation	H/L	Yes
Quaternary	Quaternary Alluvium	L/L	No
Eocene	Wasatch Formation	H/L	Yes
Eocene	Green River Formation (Fontinella Member)	L/H	No
Eocene	Green River Formation (Angelo Member)	H/H	Yes
Eocene	Green River Formation (Fossil Butte Member	H/H	Yes
Cretaceous	Aspen Shale	L/H	No
Cretaceous	Garnet Group	L/L	No
Cretaceous	Frontier Formation	H/H	Yes
Cretaceous	Hilliard Shale	L/H	No
Certaceous/Paleocene	Evanston Formation	H/H	Yes
UTAH			
Eocene	Knight Conglomerate	H/H	Yes
Cretaceous	Frontier Formation	H/H	Yes
Cretaceous	Kelvin Formation	H/L	Yes
Cretaceous-Paleocene	Wanship Formation	M/M	No
Cretaceous	Aspen Shale	L/H	No
Jurassic	Morrison Formation	H/H	Yes
Jurassic	Nugget Formation	M/L	No
Jurassic	Twin Creek Limestone	L/H	No
Permian	Park City Formation	L/H	No
Triassic	Thaynes Formation	H/H	Yes
Triassic	Ankareh Formation	L/H	No
Tertiary	Tertiary Volcanics	L/L	No
Miocene	Bishop Conglomerate	L/L	No
Eocene	Uinta Formation	H/H	Yes
Jurassic	Curtis Formation	L/H	No
Pennsylvanian-Permian	Oquirrh Formation	L/H	No
Cretaceous	Price River Formation	L/L	No
Eocene	Green River Formation	H/H	Yes
Tertiary	Tertiary terrace deposits	L/L	No
Cretaceous-Paleocene	Upper Red Narrows Conglomerate	L/L	No
Paleocene-Eocene	Colton-Green River Formation	H/L	Yes
Paleocene-Eocene	Flagstaff Formation	M/M	No

Figure 4.2-9


374.0
370 KR
380 KR
Central
Utah Power House
5203
5705
Ranch
4565
Cedar Break
Harrison Peak
Pintura
Farm
LEGEND
PROPOSED COMPRESSOR STATION
PROPOSED PIPELINE
PROPOSED ALTERNATIVE PIPELINE
120 KR PIPELINE MILEAGE (INTERVAL: 10 MILES)
120.5 IMPACT MILEAGE
HIGH IMPACT
MODERATE IMPACT
LOW IMPACT
NORTH
Scale (appx.)
0 .5 1 3
Miles

MOJAVE · KERN RIVER · EL DORADO
NATURAL GAS PIPELINE PROJECTS

KERN RIVER PROPOSAL

SOURCE: DIXIE NATIONAL FOREST
TAKATA ASSOCIATES

Table 3.1-28 (continued)

PALEONTOLOGICAL FORMATIONS, KERN RIVER PROPOSAL

Age	Formation	Potential 1/ Vertebrate/ Invertebrate	Sensitivity
CALIFORNIA			
Quaternary	Quaternary alluvium	H/L	Yes
Pennsylvanian	Bird Spring Group	L/H	No
Mississippian	Monte Cristo Group	H/L	Yes
Permian	Kaibab Formation	L/L	No
Pleistocene	Pleistocene nonmarine sediments	L/L	No
Precambrian-Holocene	Igneous/metamorphic rocks	L/L	No
Quaternary	Quaternary lake deposits	L/L	No
Tertiary	Tertiary nonmarine sediments	H/L	Yes
Holocene	Holocene dune sand	H/L	Yes
Upper Miocene	Chanac Formation	H/H	Yes
Holocene	Holocene alluvial fan	L/L	No
Quaternary	Quaternary nonmarine terrace	L/L	No
Middle Miocene	Barstow Formation	H/L	Yes
TAFT LATERAL			
Holocene	Holocene alluvial fan	L/L	No
Holocene	Holocene dune sand	L/L	No
Pliocene/Pleistocene	Tulare Formation	H/L	Yes
KERN LATERAL			
Holocene	Holocene alluvial fan	L/L	No
Holocene	Holocene basin deposits	L/L	No
Quaternary	Quaternary nonmarine deposits	L/L	No
Uppermost Miocene	Kern River Formation	H/L	Yes

1/ L = Low, M = Moderate, H = High

The Nevada scenic environment is generally characteristic of the Mojave-Sonoran Desert. The landforms consist of valleys, hills, alluvial fans, and washes, steep mountains, and vestigial volcanic formations. Vegetation is sparse.

The California scenic environment is generally characteristic of the Mojave-Sonoran Desert. The landforms consist of steep mountains, hills, valleys, alluvial fans, washes, and vestigial volcanic formations. Vegetation is sparse.

The colors of the changing landscape pass from the green and granite gray of the Wyoming and Utah mountains to the brown, red-brown, gray-browns and gray-greens of the Nevada and California landscape. Textures are rugged and coarse in the steep mountainous terrain, medium to coarse for the mountain/ foothill areas, and smooth to fine for the alluvial fan and wash areas.

Man-made features are more dominant in urbanized areas and centers, especially Salt Lake City and Las Vegas. There are no known architectural structures of scenic significance.

The three-stage methodology for identifying the existing visual environment for this EIR/EIS has been described in Section 3.1.12 in Volume I. The visual resource analysis techniques developed by the Forest Service and the Bureau of Land Management have also been presented in Section 3.1.12 in Volume I.

3.1.12.1 Kern River Mainline

MP 48-53, VRM/VQO: BLM Class II
Description: Bear River Valley. The landform consists of lower, transitional slopes to high elevation valleys at 6,900 feet between the Wasatch Range and Bear River Divide Ranges. Modifications include the town of Evanston, Union Pacific Railroad, Highway 150, ranches, and ranch access roads.

MP 112.5-146.0, VRM/VQO: FS Class R, PR, M
Description: Uinta National Forest. The landform consists of sloping terrain along foothills between higher peaks at a general elevation of 8,000 feet. Modifications include seasonal Highway 169, US Highways 6 and 40, a radio tower, various access roads and transmission lines. The Uinta National Forest has categorized the scenic resources within National Forest System lands. The predominant visual quality objectives in the analysis corridor are Retention and Partial Retention. The scenic variety is predominantly Classes A and B. Critical viewpoint concerns are along the Forest roads, trails, and at developed recreation sites that parallel or are crossed by the route, and the crossings of Highways 40 and 6.

MP 220-223 (approximately), VRM/VQO: BLM Class II
Description: Scipio Pass. The landform on the east side of I-15 slopes steeply to the 9,000 foot elevation. Modifications on the east side include the frontage road, a 12.5kV distribution line, a radio tower and microwave station, telephone cables, and cleared rangeland. The landform on the west side is less steeply sloped and modified, and includes a 69kV transmission line. The vegetation consists of mountain brush mixed with pinyon-juniper forest. Modifications include I-15 (a four lane freeway with a median which varies from approximately 40-200 feet), the modifications previously listed plus underpasses for agricultural and rangeland operations. It is a scenic area highly visible from northbound and southbound lanes of I-15.

MP 260-270 (approximately), VRM/VQO: BLM Class IV
Description: Baker Canyon. The landform consists of primarily flat to gently rolling hills which are covered with pinyon-juniper vegetation. The line is not visible from I-15, the nearest significant viewpoint and modification.

MP 275-280 (approximately), VRM/VQO: BLM Class III
Description: Pinnacle Pass. The landform consists of steeply sloping mountains that rise from 5,800-7,000 feet. The pipeline passes over a ridgeline close to Pinnacle Peak and is visible from I-15. The vegetation consists of pinyon-juniper forest. Modifications include I-15.

MP 358.3-377.5 (approximately), VRM/VQO: FS Class M, PR
Description: Dixie National Forest. The landform consists of a narrow mountain valley between Pine Valley and Bull Valley Mountains. The vegetation consists of sagebrush and buckbrush scrub, ponderosa pine, and other mid-elevation species. Modifications include telephone transmission lines, Highway 18, interspersed ranches, and access roads. The Dixie National Forest has categorized the scenic resources within US Forest system lands. The predominant visual quality objective in the analysis corridor is Modification and the scenic variety is predominantly Class C. There are no critical viewpoint concerns.

MP 488-493.6 (approximately), VRM/VQO: BLM Class II and IV
Description: Las Vegas Wash/Rainbow Gardens Wetlands. The landform consists of wetlands and flat, intermittent washes adjacent to small hills. Irregular erosion patterns have revealed vivid soil colors with textured variety, making the area geologically unique. The vegetation consists of creosote bush scrub, mesquite and sagebrush scrub, and riparian plant communities in wetland areas. Modifications include the Union Pacific Railroad tracks, a secondary road, mines, Highway 93, the community of East Las Vegas, the city of Henderson, power plants and transmission lines.

MP 493.6-494.3, VRM/VQO: Clark County Land
Description: Clark County Wetlands Park. The landform consists of wetlands and flat, intermittent washes. The vegetation

consists of marsh plants and sagebrush scrub. The Master Plan for the Wetlands Park proposes modifications such as a study shelter, an orientation and information center, and equestrian and hiking trails.

MP 541.5-550 (approximately), VRM/VQO: BLM Class IIa, III
Description: Clark Mountains. The landform consists of transition slopes between the flat desert terrain (Ivanpah Valley), low desert peaks up to 7,000 feet, and narrow Keany Pass. The vegetation consists of sagebrush scrub and pinyon-juniper forest. Modifications include mines, jeep trails, access roads, buried transmission cables, and I-15. This segment of the pipeline is within the viewshed of I-15 and is within the utility corridor identified by the BLM California Desert Plan.

MP 550-555, VRM/VQO: BLM Class IIb
Description: Shadow Valley. The landform consists of flat desert terrain. The vegetation consists of creosote bush scrub. Modifications include a light duty road, water well, and mine access roads.

MP 638-641, VRM/VQO: BLM Class IIb
Description: Mud Hills. The landform consists of transition slopes from flat, desert terrain to small desert foothills. The vegetation consists of creosote bush scrub. Modifications include jeep trails and other access roads.

3.2 NORTHWEST PROPOSAL

Because Northwest's proposed tap and metering facilities would be constructed in an area immediately adjacent to Kern River's proposed Compressor Station No. 1, baseline environmental conditions are identical to those presented in Section 3.1 for Kern River.

3.3 KERN RIVER ROUTE VARIATIONS

The information presented below is limited to a description of environmental characteristics associated with each route variation where these characteristics are unique or differ significantly from those associated with the proposed route. The reader is referred to Section 3.1 for information on topics not addressed under a particular route variation.

3.3.1 Wasatch Variation

3.3.1.2 Geology

The Wasatch Variation would cross the Middle Rocky Mountains and the Basin and Range physiographic regions. The geology and physiography of the Wasatch Variation is summarized in Table 3.3-1; geologic information presented in Sections 3.1.2.2 and 3.1.2.3 is pertinent to this variation.

Table 3.3-1

GEOLOGIC AND PHYSIOGRAPHIC CONDITIONS, WASATCH VARIATION

	MP 73 to Bountiful	Bountiful to Scipio
Geo/Phys Province	Middle Rocky Mtns.	Basin and Range
Geologic Unit	Sedimentary rock, volcanics; alluvium	Sedimentary and igneous rock; lacustrine, alluvium; volcanics
Age	Precambrian to Tertiary; recent	Pennsylvanian to Tertiary; recent
Topography	Very high relief, rugged very steep slopes	Low to moderate relief locally steep slopes
Comments	Landslides, stream crossings	Active faults, liquefaction, stream crossings, landslides

3.3.1.2.1 Middle Rocky Mountains (MP 0-49)

Geology and Physiography. This variation begins on a ridgeline and travels nearly due west on moderately steep ridges and through rugged mountains with high relief. The route is underlain by Precambrian to Cretaceous sedimentary rock, Tertiary igneous rock, and recent alluvial deposits. Only moderate erosional features were observed during the aerial reconnaissance with the exception of those areas associated with disturbed lands or slump slide areas where moderate to high erosion activity was observed. Portions of the route are unstable, prone to avalanches, and subjected to seasonally or perennially high water tables.

Faulting and Seismicity. The alternate route crosses the Warm Springs segment of the Wasatch fault at the south end of North Salt Lake, Utah (MP 49). Geologic evidence indicates that earthquakes as large as magnitude 7.5 have occurred on the Wasatch Fault in the last 1,500 years [Swan et al., 1978].

Slope Stability. Numerous large and small landslides were observed and have been mapped throughout the area by Golder Associates [1986], the Forest Service [1986b], and the Utah Geologic and Mineral Survey [Kaliser, 1986]. This variation would cross through an area which experienced a significant increase in landslide activity in 1983 through 1984. Many of these landslides are still active and additional slides continue to develop. The route generally avoids any large deep-seated landslides.

Landslides and features associated with instability were noted at MP 0-12 in the Chalk Creek area. Most of the unstable areas were on the steep hillsides and did not include the ridgeline where the variation would be placed.

On the east side on the Wasatch Mountains (MP 18-38) several small landslides were observed during aerial reconnaissance. These slides appear to be limited in size and extent in comparison with other areas along the primary route and this variation. In addition, several landslides have been mapped in the Holbrook Canyon area by both the Forest Service [1986c] and the Utah Geologic Mineral Survey [Kaliser, 1986].

The Wasatch Front area of the variation (MP 38-48) on the west side of the Middle Rocky Mountains has been subjected to significant landslide activity during the period 1983-1986. Over 93 landslides and debris flows have been mapped wtihin the watershed boundaries or within a few miles of the proposed Wasatch Variation route [Kaliser, 1986]. Aerial reconnaissance during the spring of 1986 indicated the presence of numerous areas of fresh slumping and debris flows. Slope cracks and water seeps exist along the variation between MP 18 and 48. The geometry of the slopes being crossed is no guarantee of stability. Slides have occurred on both concave and convex slopes between these milepost designations.

Mineral/Petroleum Resources. The variation passes near two existing coal mines located along Chalk Creek (MP 5) but will not affect any coal leases or potential mining operations. In addition, several commercial sand and gravel operations exist in the Chalk Creek area. However, the route does not cross through any existing mining operations.

This variation crosses near or is contiguous to several large drilling pads (MP 0-5) which are located on an active oil and gas field.

3.3.1.2.2 Basin and Range (MP 49-154)

Geology and Physiography. The Wasatch Variation would enter the Basin and Range region near the south end of North Salt Lake. The route within the Basin and Range is underlain by Pleistocene lacustrine deposits in the valley floors and alluvial fan deposits on the footslopes. Where the route crosses through the mountain ranges, it is underlain by thin soils and exposed Pennsylvanian sedimentary and Tertiary volcanic bedrock. Local relief is generally less than 300 feet.

Faulting and Seismicity. The route would cross the northern end of the West Valley Fault Zone between MP 54 and 57, west and southwest of Salt Lake City International Airport. The main trace of the West Valley Fault Zone (also known as the Granger Fault) exhibits over 40 feet of Holocene displacement.

A significant portion of the route crosses liquefiable deposits, particularly deposits associated with the Jordan River floodplain, and the Cedar and Goshen Valleys.

Mineral/Petroleum Resources. This variation would pass contiguous to existing sand and gravel pits. It is not known to pass near or through any other existing or proposed mining operation along this segment of its route, although near the town of Elberta, the route does traverse an alluvial fan immediately above Sunshine Mining Company's mine water discharge evaporation ponds.

3.3.1.3 Soil

For a detailed description of the soil mapping units along the route of this variation and the milepost at which they would occur, refer to Appendix A.

3.3.1.3.1 Middle Rocky Mountains (MP 0-48.5)

The portion of the Wasatch Variation within the Middle Rocky Mountains region of northern Utah would traverse predominantly deep soils on mountains, foothills, and a few valleys. Shallow soils are less common and occur on mountains and foothills. Topography is dominantly steep to moderately steep with gentle slopes in valleys. Soil susceptibility to water erosion is mostly moderate to very high with some areas of low potential on gentle slopes. Wind erosion potential is mostly low to moderate. Reclamation potential is mostly fair to poor. Soil depth, rock fragments, clayey texture and steep slopes are the primary limiting factors [SCS, 1968, 1976b, 1978b, 1980, 1981b; USFS, 1986c, 1986e]. The soils on steep slopes along this route are very susceptible to mass failure as described in greater detail in Section 3.2.1.2.

3.3.1.3.2 Basin and Range (MP 48.5-154.0)

The portion of the Wasatch Variation within the Basin and Range of northern Utah would traverse predominantly deep soils on fans, terraces and plains. Shallow soils are less common and occur on foothills and mountains. Topography is mostly level to rolling, with some steep slopes on mountains. Soil susceptibility to water erosion is mostly low to moderate, and ranges to high only on limited areas of steep slopes. Wind erosion potential is mostly low to moderate. Reclamation potential is distributed over the good to poor range. Soil depth, rock fragments, salinity, alkalinity, and slope are the primary limiting factors [SCS, 1944, 1976a, 1977c, 1980c, 1984, 1986e].

3.3.1.4 Surface Water

Major USGS-designated river basins that the Wasatch Variation would traverse include the Weber, Jordan, and Sevier Rivers. Approximately 16 perennial, 30 intermittent, six irrigation canals, and numerous ephemeral drainage channels would be crossed by the variation. Table 3.3-2 lists the major intermittent and perennial streams that would be crossed by the variation in addition to sensitivity to crossing for the perennial streams. The surface water resources that would be encountered along this variation would be very similar to those described previously in Sections 3.1.4.2 and 3.1.4.3 within the Middle Rocky Mountains Mountains and the Basin and Range provinces, respectively. If the variation was constructed in the near future, a large wetland area would be encountered where the rising Great Salt Lake backs up into the Jordan River north of Salt Lake City, Utah. Of particular note is the Mill Creek drainage which is a municipal watershed for the City of Bountiful, Utah. The variation would traverse this watershed.

Table 3.3-2

MAJOR DRAINAGE CHANNELS, WASATCH VARIATION

Drainage Basin	Drainage Channel	Class 1/ Flow	Sensitivity 2/ Channel Bed	Side slope	Mile-post
Weber	South Fork Chalk Creek	P	L	L	8.8
	Chalk Creek	P	M	H	8.8-15.0
	Weber River	P	L	M	15.5
	Lewis Canyon	I	-	-	16.8
	Corridor Canyon	I	-	-	18.0
	Franklin Canyon	P	M	M	20.6
	Dry Fork Franklin Canyon	I	-	-	21.0
	Right Fork Franklin Canyon	I	-	-	22.3
	Dip Hollow	I	-	-	23.6
	Dip Hollow	I	-	-	24.4
	Dixie Hollow	P	M	H	25.0
	Rock Canyon	I	-	-	26.3
	Tucson Hollow	I	-	-	27.2
	East Canyon Creek	P	M	H	28.8
	Sheep Canyon	P	M	H	29.9
	Jones Hollow	I	-	-	30.8
	Woods Creek	P	H	H	31.5
	Adams Hollow	I	-	-	32.5
	Tucker Hollow	I	-	-	33.7
	Hardscrabble Creek	P	H	H	35.5
	Beaver Creek	P	H	H	35.5
	Wolton Creek	P	H	H	35.9

Table 3.3-2 (continued)
MAJOR DRAINAGE CHANNELS, WASATCH VARIATION

Drainage Basin	Drainage Channel	Class 1/ Flow	Sensitivity 2/ Channel Bed	Side slope	Mile-post
Great Salt Lake Basin	Holbrook Creek	P	H	H	40.7
	Kenney Creek	I	-	-	41.7
	Mill Creek	P	H	H	42.9
	North Canyon	I	-	-	44.4
	North Fork Hooper Canyon	I	-	-	45.2
	South Fork Hooper Canyon	I	-	-	45.5
Jordan River	Unnamed	I	-	-	46.6
	Unnamed	I	-	-	46.8
	Unnamed canals	-	-	-	48.7
	Jordan River	P	L	L	50.0
	Rudy Drain	-	-	-	51.1
	North Point Consolidated Canal	-	-	-	54.0
	West Branch Brighton Canal	-	-	-	56.7
	Ridgehurl Canal	-	-	-	56.9
	Netlands	-	-	-	60.0-61.0
	Utah & Salt Lake Canals	-	-	-	63.0
	Bingham Creek	P	M	M	71.5
	Midas Creek	I	-	-	74.1
	Butterfield Creek	I	-	-	74.9
	Rose Creek	I	-	-	76.3
	Wood Hollow	I	-	-	78.9
	Beef Hollow	I	-	-	82.6
	Tickville Gulch	I	-	-	87.1
	Unnamed	I	-	-	115.4
	Gerbert Gulch	I	-	-	126.4
	Kimbellra	I	-	-	126.6
Sevier River	Unnamed	I	-	-	140.2
	Unnamed	I	-	-	142.8
	Middle Fork Sage Valley	I	-	-	144.0
	Middle Fork Sage Valley	I	-	-	144.2
	Sevier	P	L	L	149.0

1/ I = intermittent, P = perennial,
- = ditch or canal, artificial flow

2/ Sensitivity: Channel Bed Gradient
L = Low 0-1% M = Moderate 1-3% H = High > 3%
Sideslope (topographic slope)
L = Low 0-5% M = Moderate 5-20% H = High > 20%

3.3.1.5 Groundwater

Specific conditions along this variation would be similar to those listed in Table 3.1-8 for MP 60-180 of the proposed route within the Middle Rocky Mountains, and MP 180-190 within the Basin and Range province. This portion of the route is underlain by the Farmington metamorphic complex of gneisses, schists, and associated rocks. Studies of subwatersheds in nearby Farmington Canyon have demonstrated significant groundwater movement from one small drainage to another.

3.3.1.6 Freshwater Biology

Eleven perennial streams would be crossed along the Wasatch Variation within the Middle Rocky Mountain region, many of which contain significant game fisheries (Table 3.3-3). Typical species that occur in drainages of this region are listed in Table 3.1-10. Many of the streams proposed for crossing are biologically diverse, supporting a complex assemblage of aquatic invertebrates, algal forms, and fish populations.

East Canyon Creek, a Class A stream considered critical habitat by the Utah Division of Wildlife Resources, would be crossed by this section of the pipeline. Crossings are also proposed for an additional seven streams rated as Class B, two streams rated as Class C and one rated as Class U. No species of special concern occur in drainages within this region.

Two perennial streams, the Jordan River and the Sevier River, would be crossed by the Wasatch Variation within the Basin and Range region (Table 3.3-3). However, most drainages that would be crossed within this region are ephemeral or intermittent. Commonly occurring species of the Basin and Range region are listed in Table 3.1-12. The Jordan and Sevier Rivers have been rated by BIO/WEST as Class B streams. These rivers support game fisheries composed of warm and cool water fish. No species of special concern occur within the region.

3.3.1.7 Terrestrial Biology

3.3.1.7.1 Vegetation

Middle Rocky Mountains (MP 0-48.5)

General Vegetation. This variation would traverse five distinct community types within the Middle Rocky Mountains region, including mountain brush, pinyon-juniper woodland, sagebrush scrub, agricultural land, and montane forest. Narrow bands of riparian vegetation may occur along the perennial streams that would be crossed by this variation. These types are described in Appendix B. Table 3.3-4 lists the distribution of these community types along the proposed route.

Table 3.3-3

FISHERY VALUE OF MAJOR PERENNIAL STREAMS, WASATCH VARIATION

State/ County	Stream	Approximate Milepost	Fish		State [1/] Classification	BIO/WEST [1/] Classification
			Nongame	Game		
Middle Rocky Mountains (MP 0-48.5)						
UTAH						
Summit	S. Fork Chalk Creek	8.8	X	X	h-cw-3	B
	Chalk Creek	10.0	X	X	h-cw-3	B
	Weber River	15.5	X	X	h-cw-3	B
	Franklin Canyon	20.6	-	-	s-cw-4	C
Morgan	Dixie Hollow	25.0	-	-	NC	U
	E. Canyon Creek	28.8	X	X	c-cw-2	A
	Sheep Canyon	29.9	-	X	h-cw-3	B
	Woods Creek	31.5	-	-	s-cw-4	C
	Hardscrabble Creek	35.5	X	X	h-cw-3	B
	Beaver Creek	35.5	-	X	h-cw-3	B
	Mill Creek	42.9	-	X	h-cw-3	B
Basin and Range (MP 48.5-154)						
Davis	Jordan River	50.0	X	X	h-cw-3	B
Juab	Sevier River	149.0	X	X	h-cw-3	B

[1/] Refer to Table 3.1-9 for key to classification.

Table 3.3-4

VEGETATION COMMUNITY TYPES, WASATCH VARIATION

Geographic Region	Community Type	Milepost
Middle Rocky Mountains	Mountain Brush	0-8
	Pinyon-Juniper Woodland	8-9
	Sagebrush Scrub	9-14
	Agricultural Land	14-17
	Sagebrush Scrub	17-21
	Mountain Brush	21-23
	Sagebrush Scrub	23-31
	Mountain Brush	31-38
	Montane Forest	38-40
	Mountain Brush	40-48
Basin and Range	Sagebrush Scrub	48-49
	Wetland/Riparian	49-56
	Urban	56-62
	Agricultural Land	62-75
	Sagebrush Scrub	75-80
	Pinyon-Juniper Woodland	80-90
	Sagebrush Scrub	90-111
	Agricultural Land	111-125
	Pinyon-Juniper Woodland	125-133
	Agricultural Land	133-136
	Sagebrush Scrub	136-141
	Pinyon-Juniper Woodland	141-143
	Sagebrush Scrub	143-145
	Agricultural Land	145-147
	Wetland/Riparian	147-150
	Utah Grassland	150-154

Plant Species of Special Concern. No federally listed, candidate, state protected, or state sensitive species occur in areas that would be traversed by the variation.

Basin and Range (MP 48.5-154)

General Vegetation. Within the Basin and Range region the pipeline route would traverse five community types including sagebrush scrub, wetland/riparian, agricultural land, pinyon-juniper woodland, and Utah grassland. The pipeline would traverse the wetland/riparian type associated with the Jordan River and the Sevier River. Both locations consist of saturated alluvial valley fill primarily covered by grasses and forbs with some areas covered by riparian brush such as willow and birch.

Plant Species of Special Concern. No federally listed, candidate, state protected, or state sensitive species occur in areas that would be traversed by the variation.

3.3.1.7.2 Wildlife

Middle Rocky Mountains (MP 0-48.5)

General Wildlife. The proposed Wasatch Variation would traverse five vegetation communities within this region. Wildlife species common to these communities have been previously described in Section 3.1.7.2.2.

Big game habitat occurs over most of the study area, and the variation traverses winter range that is deemed important by the UDWR [unpublished data f]. Critical mule deer winter range has been described for 21 miles of the analysis corridor; the ROW would intersect 17 of these miles. An additional five miles of high priority deer winter range lies within the analysis corridor, approximately four of which would be crossed by the ROW. Four miles of critical elk winter range would be traversed by the ROW, and ten miles of high priority elk winter range encroaches on the analysis corridor. Five miles of this habitat would be crossed by the ROW. Approximately seven miles of critical moose winter range would be traversed by the ROW.

Upland game birds in the vicinity include ruffed grouse, blue grouse and sage grouse. Critical habitat in the area of concern has only been identified for sage grouse. This is breeding habitat in association with courtship grounds (leks), and a corresponding buffer zone. The pipeline would skirt the perimeter of one buffer zone between MP 23-25; this is the only habitat of concern identified within this region [UDWR, unpublished data d].

Table 3.3-5 lists important general wildlife features and their locations along this proposed variation.

Wildlife Species of Special Concern. Two federally listed endangered species potentially occur within the area: peregrine falcon and bald eagle. The peregrine has historically nested in cliffs along the Wasatch Front. Presently the UDWR is working with the Peregrine Fund to re-establish birds in the area [USFS, 1985b]. No nests have been identified within the area of concern. Two bald eagle winter concentration areas are traversed by the proposed route for a total of approximately four miles. Both of these areas are associated with reservoirs and their corresponding adjacent river canyons: Echo Canyon and the Weber River, and East Canyon Reservoir and adjacent drainages [UDWR, unpublished data d]. During winter 1986, a noticeably high number of eagles wintered in the Echo Canyon area [Archer, 1986].

Table 3.3-5

IMPORTANT WILDLIFE HABITAT FEATURES, WASATCH VARIATION

Milepost	Wildlife Concerns
0.0-3.8	Elk - high priority winter range
1.3-3.9	Moose - critical winter range
1.6-13.4	Mule Deer - critical winter range
3.8-7.8	Elk - critical winter range
6.7-7.9	Elk - high priority winter range
8.8-13.9	Elk - high priority winter range
8.9-13.8	Moose - critical winter range
16.9-20.3	Mule Deer - critical winter range
20.2-21.1	Mule Deer - high priority range
23.8-24.6	Mule Deer - high priority range
28.8-31.9	Mule Deer - high priority range
96.0-109.1	Raptor concentrations
127.9-149.0	Mule Deer - high priority range
148.6-150.9	Waterfowl -crucial nesting/brooding

Federal candidate species that may occur within the vicinity are ferruginous hawk, Swainson's hawk and yellow-billed cuckoo. It is possible that ferruginous and Swainson's hawks may nest near broad open valleys. The yellow-billed cuckoo may occur in dense riparian woodlands. No nests for these species have been presently identified for the area of concern.

A list of all wildlife species discussed for this variation is presented as Appendix E.

Basin and Range (MP 48.5-154)

General Wildlife. Five vegetation communities have been identified within the analysis corridor in this region. Commonly associated groups of wildlife are described in Section 3.1.7.2.3.

Important big game habitat in this region is identified only for mule deer. The ROW traverses approximately 12 miles of continuous high priority winter range through the lower slopes of the East Tintic Range and adjacent valleys on the east terminating at the Sevier River [UDWR, unpublished data c].

The wetland community adjacent to the Sevier River (MP 149-151) is designated crucial geese nesting and brooding habitat [Nelson, 1986]. This area also provides habitat for other waterfowl.

Raptors nesting in the area include Cooper's hawk, red-tail hawk, Swainson's hawk, ferruginous hawk, golden eagle, northern harrier, prairie falcon, great horned owl, long eared owl, short eared owl and burrowing owl. Most identified raptor nests within this study area occur in the Lake Mountains, Cedar Valley and Goshen Valley.

Wildlife Species of Special Concern. Potentially three federally listed species occur within this study area: bald eagle, peregrine falcon and black-footed ferret. Bald eagles winter in the general locale, and UDWR [unpublished data c] has identified one winter roost site within the analysis corridor. In addition, the USFWS has designated an area in Cedar Valley as a bald eagle wintering area [Archer, 1986]. The analysis corridor crosses the perimeter of this site.

Peregrine sightings through the Salt Lake Valley and Utah Lake Valley have increased in recent years, and the potential for nesting within the study area is increasing. Hack sites have been utilized in the Great Salt Lake area in an attempt to increase the population in the region but presently no nesting is known to occur within the analysis corridor [Archer, 1986].

No prairie dog communities have been delineated for the analysis corridor, and the likelihood of a ferret population is minimal.

Federal candidate species potentially occurring in the area include ferruginous hawk, Swainson's hawk, mountain plover. western snowy plover, long-billed curlew, white-faced ibis and western yellow-billed cuckoo. The UDWR [unpublished data c] has identified eight ferruginous hawk nests in the general area, two of which lie within the analysis corridor. The broad open valleys within this region also provide suitable habitat for Swainson's hawk nesting, although no nests have been identified for the analysis corridor. Mountain plovers may occur in the area as rare migrants. Western snowy plovers could potentially nest on barren alkali flats within the study area. Potential curlew and ibis habitat exists within the wet meadow/riparian area of the Sevier River. Yellow-billed cuckoo may also occur in this area as well as other riparian zones, particularly ones that are heavily wooded.

3.3.1.7.3 Grazing

The proposed Wasatch Variation would intersect one 1,000-acre USFS livestock grazing allotment on the Wasatch range. Two other allotments border the proposed pipeline. The majority of the land intersected by the proposal is private, state or municipal land. Sheep are the predominant livestock grazed on these permanent ranges.

3.3.1.8 Socioeconomics

3.3.1.8.1 Traffic

Access in the Wasatch-Cache National Forest is absent or minimal in Holbrook Canyon (MP 40.3), Mill Creek (MP 43), and the Cave

Peak Area (MP 44). The National Forest portion of thi area is categorized as Semiprimitive Nonmotorized. The existing roads on the National Forest lands are primarily designed, constructed, and maintained for recreational rather than industrial vehicles.

The Wasatch Variation begins in Summit County, Utah, runs west and then south to rejoin the mainline in Juab County. Most of the crossings are local roads except in the counties near Salt Lake City (Table 3.3-6).

Table 3.3-6

TRANSPORTATION CORRIDOR CROSSINGS, WASATCH VARIATION

State/County	U.S. Interstate	U.S. Federal	State	County & Local	RR 1/
UTAH					
Summit	I-80	-	-	13	-
Morgan	-	-	UT 65, UT 66	6	-
Davis	I-89	-	UT 68	4	D&RG&W, UP
Salt Lake	I-80	US 215	UT 48, UT 171, UT 173, UT 201	10 -	SLG&W, WP, UP
Utah	I-6	-	UT 132	30+	-
Juab	-	-	UT 132	-	-

1/ Railroad Abbreviations: D&RG&W = Denver and Rio Grande and Western, UP = Union Pacific, SLG&W = Salt Lake Garfield and Western, WP = Western Pacific

3.3.1.9.2 Noise

The Wasatch Variation which would replace sections of the northern portions of the primary route would have approximately the same ambient noise levels as those projected for the proposed action (refer to Table 3.1-20). Portions of the Wasatch Variation which pass north and west of Salt Lake City International Airport would have ambient noise levels in excess of 65 dBA. The sections of Wasatch Variation east of Interstate 15 and south of Camp Williams have estimated ambient noise levels of 35-45 dBA.

No compressor stations would be located within the Wasatch Variation. Since no proposed compressor stations are planned and noise from construction activities represents a temporary situation, a list of sensitive noise receptors has not been developed.

3.3.1.8.3 Recreational Resources

Until the variation reaches the Wasatch-Cache National Forest, there are no designated recreational resources within the mile-wide study corridor. Land ownership between MP 38 and 46 is divided between forest and private. Near MP 44 the proposed route would be adjacent to a developed picnic area, Mueller Park, next to Mill Creek. The area is for day use only. Both group and individual areas are within .1 mile of the corridor centerline [Kline, 1986]. Three hiking trails would be crossed by the proposed route at MP 41, 42, and 42.3. These trails receive moderate year-round use by hikers and cross-country skiers [Heaton, 1986]. The dispersed recreational activities are the same as those discussed in Section 3.1.8.4. The Recreation Opportunity Spectrum class for this portion of the Forest is Semiprimitive Nonmotorized; off-road vehicles may be used only on designated trails. Permits are required for helicopter landings.

The route crosses the Jordan River near MP 50 and the Butterfield Creek near MP 72. Both of these water courses are zoned as open space in the Salt Lake County master plan. Open space may contain parks, golf courses or other recreation sites. The Jordan River Parkway, a north-south greenway, is recommended for development as a "chain of trails, parks, water features, and commercial recreation areas" [Salt Lake County Master Plan Land Use Element, 1977]. No other designated recreational sites are within the corridor of the variation.

3.3.1.9 Land Ownership/Use

The Wasatch Variation departs from the mainline at approximately MP 73 in Summit County, Utah. The land use is primarily grazing but it does pass within a 0.5 mile of Coalville (see Section 3.1.9 for a discussion of Summit County plans).

While within Morgan County the pipeline passes through land used for grazing, a rugged mountainous area. The proposed route enters the Wasatch-Cache National Forest at approximately MP 36.5. It is not within the Wasatch-Cache NF designated Ward Canyon Utility Corridor; therefore, it is not in conformance with the Forest's Land and Resource Management Plan. Utility lines are considered a conditional use in all zones according to the Morgan County Land Development Code.

Land ownership by county for the Wasatch Variation is shown in Table 3.3-7. Table 3.3-8 shows the land use by county and Table 3.1-24 shows the rules, regulations, and policies of the administrative agencies.

Table 3.3-7

LAND OWNERSHIP, WASATCH VARIATION

Miles and Percent in Utah Counties

	Summit	Morgan	Davis	Salt Lake	Utah	Juab	TOTAL
Private	22.8	13.9	7.5	30.5	37.8	19.6	132.1
	(100)	(86)	(68)	(95)	(82)	(75)	[86]
BLM	-	-	-	-	1.5	6.0	7.5
					(3)	(23)	[5]
State	-	-	-	-	6.2	0.4	6.6
					(13)	(2)	[4]
FS	-	2.3	3.5	-	-	-	5.8
		(14)	(32)				[4]
DOD	-	-	-	1.5	0.5	-	2.0
				(5)	(1)		[1]
TOTAL	22.8	16.2	11.0	32.0	46.0	26.0	154.0

Table 3.3-8

LAND USE, WASATCH VARIATION

Miles and Percent in Utah Counties

	Summit	Morgan	Davis	Salt Lake	Utah	Juab	TOTAL
Grazing/ Rangeland	22.8	11.9	6.5	6.0	45.5	26.0	118.7
	(100)	(73)	(59)	(19)	(99)	(100)	[77]
Timber/ Forestland	-	2.3	3.5	-	-	-	5.8
		(14)	(32)				[4]
Irrigated/ Non-Irrig. Agiculture	-	2.0	-	12.0	-	-	14.0
		(12)		(38)			[9]
Commercial/ Industrial	-	-	1.0	7.0	-	-	8.0
			(9)	(22)			[5]
Residential	-	-	-	5.5	-	-	5.5
				(17)			[4]
Other (DOD)	-	-	-	1.5	0.5	-	2.0
				(5)	(1)		[1]
TOTAL	22.8	16.2	11.0	32.0	46.0	26.0	154.0

In Davis County, Utah, the pipeline again crosses sections of the Wasatch-Cache NF (see above for comments). Davis County has no plans or regulations unless a county road is crossed [Burton, 1986]. There are some residences in North Canyon but not within 100 feet of the route. It does pass an oil refinery area at the foot of the Wasatch Front, and then crosses the Jordan River into Salt Lake County.

Salt Lake County is a highly developed county because of Salt Lake City which is the largest city in the state. The proposed route would cross approximately 0.25 mile of designated recreation area west of the Jordan River and then crosses about a 0.25 mile of residential area. Around the airport the land is considered industrial usage. As the pipeline traverses northeast of the airport terminal it begins to parallel an existing high voltage electrical transmission line. This area of west Salt Lake Valley is a mixture of residential and agricultural uses. The route is proposed to move away from the transmission lines in two places, one to avoid a auto salvage business and in another to avoid passing within 100 feet of a school. The rest of the area in Salt Lake County involved in the pipeline route is used for agriculture and grazing. The Salt Lake County Master Plan Land Use Element does not specifically address pipeline corridors.

The proposed route traverses approximately two miles across Camp Williams State Military Reservation (Camp Williams) in both Salt Lake and Utah Counties. The land is currently used to support military operations. These areas have high volumes of traffic. The route runs parallel to a major access road and landing strips. The land in Utah County is used for grazing. See Section 3.1.9 for discussion of Utah County Plans.

In Juab County the Wasatch Variation ends its 154 mile journey by connecting to the mainline at approximately MP 204. The land in Juab County is used for grazing. Refer to Section 3.1.9 for discussion of Juab County plans.

3.3.1.10 Cultural Resources

3.3.1.10.1 Archaeology

The Wasatch Variation is about 154 miles long. Only five surveys have been conducted within or partially within the mile-wide analysis corridor. These surveys have covered about 0.9 miles (0.6 percent) of the construction ROW.

There are 33 documented cultural resource sites situated in the analysis corridor, including 30 prehistoric and three historic sites. The prehistoric sites are primarily lithic scatters and campsites. Three sites with rock features and one quarry site are also known. Historic sites include a mine, a cemetery, and the Hostess House at Camp Williams; the Hostess House has been nominated to the National Register.

3.3.1.10.2 American Indian Concerns

This variation falls within the traditional ethnographic use areas of the Ute Indian Tribe of Utah. Their particular concerns have been discussed in Section 3.1.10.2.

3.3.1.11 Paleontological Resources

Refer to Table 3.3-9 for a summary of significant formations crossed by the variation.

Table 3.3-9

PALEONTOLOGICAL FORMATIONS, WASATCH VARIATION

Age	Formation	Potential 1/ Vertebrate/ Invertebrate	Sensitivity
Paleocene-Eocene	Knight Conglomerate	H/H	Yes
Cretaceous-Paleocene	Wanship Formation	M/M	No
Quaternary	Quaternary alluvium	H/L	Yes
Cretaceous	Frontier Formation	H/H	Yes
Paleocene	Almy Formation	L/H	No
Eocene	Fowkes Formation	H/H	Yes
Jurassic	Preuss Sandstone	L/H	No
Cretaceous	Echo Canyon Conglomerate	L/H	No
Eocene	Norwood Tuff	H/L	Yes
Paleocene-Eocene	Wasatch Formation	H/L	Yes
Precambrian	Precambrian Metamorphic	L/L	No
Tertiary	Tertiary Sedimentary Rocks	L/L	No
Pleistocene	Lake Conneville Group	H/H	Yes
Pliocene	Salt Lake Group	H/H	Yes
Mississippian	Great Blue Formation	L/H	No
Pennsylvanian-Permian	Oquirrh Formation	L/H	No
Mississippian	Mississippian Marine Sediments	L/H	No
Devonian/Mississippian	Pinyon Peak	L/H	No
Cambrian	Ophir Formation	L/H	No
Ordovician-Devonian	Ordovician-Devonian Marine Sediment	H/H	Yes

---

1/ L = Low, M = Moderate, H = High

3.3.1.12 Visual Resources

Refer to Section 3.1.12 for methodology.

MP 36.4-44.4, VRM/VQO: FS CLass PR,R
Description: Wasatch-Cache National Forest. The landform generally consists of mountainous terrain and steep slopes. The variable mountainous topography is the background to the communities in the Salt Lake Valley. The Wasatch-Cache National Forest contains significant recreational areas, scenic creeks and mountains, and some cultural modifications. National Forest features include Kenney Creek, Mill Creek, Cave Peak, and North Canyon. National Forest recreation areas include Mueller Park which contains picnic areas and trails. National Forest modifications include fire access/breaks, and Forest Service roads. Other modifications not in the Wasatch-Cache National Forest but having potential viewpoint concerns include Interstate 15, and Highways 91 and 215. The Wasatch-Cache National Forest has categorized the scenic resources within National Forest System lands. The predominant visual quality objectives in the analysis corridor are Retention and Partial Retention. The scenic variety is predominantly Class A and B. Critical viewpoint areas are those associated with the Bountiful City street leading into Mueller Park Picnic Ground, Mueller Park Picnic Ground itself, Forest trails, and the crossings of and vistas from I-15 and Highways 91 and 215.

3.3.2 West Strawberry Variation

3.3.2.2 Geology

Geology and Physiology. The West Strawberry Variation lies wholly within the Middle Rocky Mountains. It begins near the west end of Strawberry Reservoir and connects with the primary route near the north end of the San Pitch Mountains east of Nephi. Approximately 17 miles of the alternate route is very steep and rugged. The route is underlain by Pennsylvanian to Tertiary age sedimentary rock (including the North Horn, Green River, and Uinta Formations), Tertiary volcanics and recent alluvial deposits. Relief is very high, frequently reaching over 3,000 feet. High mountains and steep canyons dominate the area. The general geologic and physiographic conditions of the West Strawberry Variation are presented in Table 3.3-10.

This variation follows ridgelines where feasible; however, the ridgelines are steep and narrow and sometimes unstable. In some areas the ridgeline ends abruptly at the head of extremely steep slopes. Landslides, avalanches, rock outcrops, and severe erosional problems are encountered along the route. The Strawberry Valley Fault, which bounds the east side of Strawberry Valley, exhibits evidence of Holocene activity and could be a source of strong ground-shaking [Golder Associates, 1986]. Strawberry

River alluvial deposits might be susceptible to liquefaction in such an event.

Table 3.3-10

GEOLOGIC AND PHYSIOGRAPHIC CONDITIONS, WEST STRAWBERRY VARIATION

	MP 120-178
Geo/Phys Province	Middle Rocky Mountains
Geologic Unit	Sedimentary rock; volcanics; alluvium
Age	Pennsylvanian to recent
Topography	Very high to gently rolling relief
Comments	Minor landslides, avalanches, saturated valleys

Faulting and Seismicity. The area is seismically active and has experienced moderate intensity seismic events.

Slope Stability. This variation parallels and crosses Tie Fork Creek on the Uinta NF numerous times.

The route crosses alluvium of Tie Fork Creek which may be up to 20 feet thick and is actively eroding. No obvious landslides occur in the alluvium, although stream erosion of creek banks results in local sloughing of alluvial material. At MP 33.8 the route crosses within 100 feet of the lead scarp of an active rockfall area which is about five acres in extent. Only a few landslides were observed along the West Strawberry Variation, and none of these directly crossed the pipeline alignment [Golder Associates, 1986]. However, the occurrence of slope failures adjacent to the alignment indicates that these units are slide-prone. Landslides that were observed all appear to be shallow soil slumps, debris slides, and rockfalls [Golder Associates, 1986].

The variation follows Jones Ridge and then crosses Browns Peak, a very steep area with active landslides and slumps. The Forest Service indicates that several significant deep-seated landslides were observed along this variation and that the length of unstable landforms varies from two to three miles [FS, 1986a]. This segment traverses steep slopes on the North Horn Formation and associated unconsolidated colluvium which are known to be very unstable given certain geologic conditions, steep slopes, and abundant water. Generally the rock layers on the Wasatch

Plateau dip to the northwest. Water which enters the groundwater regime along the top of the Plateau flows down-dip perched by impermeable rock layers and emerges as springs and seeps along the west flank. Soil creep and massive landslides are common on outcrops of the North Horn Formation along the west flank. This route also crosses high mountains with a high frequency of avalanche activity.

3.3.2.3 Soil

The West Strawberry Variation would lie within the Middle Rocky Mountains region of Utah (MP 0-64) and would traverse predominantly deep soils on mountains, foothills and valleys. Shallow soils are less common and occur on mountains and foothills. Topography ranges from gently sloping valleys, alluvial fans and plateaus to steep mountains. Soil susceptibility to water erosion is distributed over the low to very high range, with low potential on gentle slopes and very high potential on steep slopes. Wind erosion potential is low to moderate. Reclamation potential is distributed over the good to poor range. Soil depth, rock fragments, clayey texture, and steep slopes are the primary limiting factors [SCS, 1968, 1976b, 1978b, 1980a, 1981b; USFS, 1986c, 1986e]. See Appendix A for a detailed description of the soil mapping units along the route of this variation and the mileposts at which they would occur.

3.3.2.4 Surface Water

The West Strawberry Variation would traverse both the Colorado River and the Jordan River basins within the Middle Rocky Mountains physiographic province. The major stream that would be crossed in the Colorado River basin is the Strawberry River. The Jordan River drains terminally into the Great Salt Lake basin. Approximately 16 perennial, four intermittent, and numerous ephemeral drainages would be crossed by this variation. Table 3.3-11 lists the major intermittent and perennial streams that would be crossed by the variation as well as the sensitivity of the streams. The surface water resources that occur along the variation route are not significantly different from those previously described for the Wasatch Mountains in Section 3.1.4.1.2.

3.3.2.5 Groundwater

General groundwater conditions along the West Strawberry Variation are similar to those described in Section 3.1.5 for the mountainous region. General groundwater conditions in the vicinity of this variation are as previously described for the proposed mainline. Specific conditions are described in Table 3.1-8.

Table 3.3-11

MAJOR DRAINAGE CHANNELS, WEST STRAWBERRY VARIATION

			Sensitivity 2/		
Drainage Basin	Drainage Channel	Class 1/ Flow	Channel Bed	Side Slope	MP
Colorado River	Strawberry River	P	L	L	0.2
	Willow Creek	P	L	L	2.4
	Strawberry River	P	L	L	5.3
	Clyde Creek	P	M	M	7.5
	Mud Creek	P	M	M	9.2
	Bryant's Fork	P	H	H	10.7 and 10.8
	Unnamed	I	-	-	11.7
	Unnamed	I	-	-	12.4
	Horse Creek	P	M	M	13.2
	Squaw Creek	P	H	M	14.3
	Crooked Creek	P	L	L	16.2
	Indian Creek	P	L	L	16.2
	Chipman Creek	P	M	M	17.9
	Buffalo Canyon Creek	I	-	-	21.2
Jordan River	Tie Fork	P	H	H	25.0-27.3
	Soldier Creek	P	M	H	28.2
	Thistle Creek	P	M	H	44.8
	Snail Hollow	I	-	-	48.3
	Uinta Gulch	P	H	H	53.2
	Water Hollow	P	L	M	61.1

1/ I = intermittent, P = perennial

2/ Sensitivity:
Channel Bed: L = Low 0-1% M = Moderate 1-3% H = High >3%
Sideslope: L = Low 0-5% M = Moderate 5-20% H = High >20%
(topographic slope)

3.3.2.6 Freshwater Biology

General Freshwater Biology. All streams that would be crossed by the West Strawberry Variation lie within the Middle Rocky Mountains region. Perennial streams that would be crossed by the West Strawberry Variation (Table 3.3-11) typically are cold water trout streams with a diverse flora and fauna. Common species inhabiting these streams are listed in Table 3.1-12. Seven crossings occur in stream sections with high quality trout fisheries (Class B), and six stream crossings exhibit moderate quality fisheries (Class C).

Table 3.3-12

FISHERY VALUE OF MAJOR PERENNIAL STREAMS, WEST STRAWBERRY VARIATION

State/ County	Stream	Approximate Milepost	Fish		State 1/ Classification	BIO/WEST 1/ Classification
			Nongame	Game		
Middle Rocky Mountain Region (MP 0-64)						
UTAH						
Wasatch	Strawberry River	.2	X	X	h-cw-3	B
	Strawberry River	5.3	X	X	h-cw-3	B
	Clyde Creek	7.5	X	X	h-cw-3	B
	Mud Creek	9.2	X	X	h-cw-3	B
	Bryant's Fork	10.7	X	X	h-cw-3	B
	Bryant's Fork	10.8	X	X	h-cw-3	B
	Horse Creek	13.2	X	X	s-cw-4	C
	Squaw Creek	14.3	X	X	c-cw-4	C
	Crooked Creek	16.2	X	X	s-cw-4	C
	Indian Creek	16.2		X	s-cw-4	C
	Tie Fork	25.0-27.3	X	X	h-cw-3	B
Utah	Soldier Creek	28.2	X	X	s-cw-4	C
Sanpete	Thistle Creek	44.8		X	s-cw-4	C

1/ Refer to Table 3.1-9 for key to classifications.

Aquatic Species of Special Concern. The leatherside chub, a candidate for federal endangered species status, is found in two streams crossed by the West Strawberry Variation. The Utah Division of Wildlife Resources lists leatherside chub populations as being stable in the State of Utah [UDWR, unpublished data a].

3.3.2.7 Terrestrial Biology

3.3.2.7.1 Vegetation

General Vegetation. The West Strawberry Variation route would traverse the Wasatch Mountains of the Middle Rocky Mountain region (MP 0-64). Community types that would be traversed include wetland/riparian, montane forest, sagebrush scrub, mountain brush, pinyon-juniper woodland, and agricultural lands. These types are described in Appendix B. Table 3.3-13 lists the distribution of these types along the proposed pipeline variation route.

Table 3.3-13

VEGETATION COMMUNITY TYPES, WEST STRAWBERRY VARIATION

Geographic Region	Community Type	Milepost
Middle Rocky Mountains	Wetland/Riparian	0-7
	Montane Forest	7-15
	Sagebrush Scrub	15-17
	Montane Forest	17-22
	Mountain Brush	22-25
	Wetland/Riparian	25-27
	Mountain Brush	27-28
	Pinyon-Juniper Woodland	28-34
	Montane Forest	34-43
	Pinyon-Juniper Woodland/Mtn. Brush	43-48
	Sagebrush Scrub	48-51
	Pinyon-Juniper Woodland/Mtn. Brush	51-61
	Agricultural Land	61-64

Plant Species of Special Concern. One federally listed endangered species, clay phacelia, and three candidate species may occur in areas that would be traversed by the variation route. Clay phacelia grows on barren shale slopes of the Green River geologic formation at about 6600 feet elevation. Descriptions of these species and habitat are presented in Appendix B.

3.3.2.7.2 Wildlife

General Wildlife. The West Strawberry Variation would cross six vegetation community types. Wildlife groups commonly occurring within these communities have been previously described under the Middle Rocky Mountains region of the proposed mainline.

Big game in this region include mule deer, elk, moose, black bear, and mountain lion. The proposed alignment would traverse designated sensitive habitat for mule deer and elk [UDWR, unpublished data c]. Critical deer winter range occurs along ten miles of the analysis corridor and eight miles of the ROW. The ROW also crosses 12 miles of high priority deer winter range. Elk critical winter range is traversed by the ROW for approximately two miles, and high priority winter range by an additional two miles. Habitat deemed critical for calving occurs along the analysis corridor for over seven miles, and is crossed by the ROW for approximately five of these miles.

The proposed ROW traverses about 14 miles of high priority nesting/brooding habitat for sage grouse along the west side of Strawberry Reservoir [UDWR, unpublished data c].

Many raptors nest in the general vicinity of this proposed variation, particularly on the west side of Strawberry Reservoir where a concentrated area of nesting occurs. Over 30 nests have been identified by the UDWR [unpublished data c] in this area; five are within the analysis corridor and include four red-tailed hawk and one goshawk nest.

Table 3.3-14 lists important general wildlife features and their locations along this proposed variation.

Wildlife Species of Special Concern. Three federally listed endangered species potentially occur within the area: whooping crane, peregrine falcon, and bald eagle. The whooping crane could possibly be a very rare migrant within the Strawberry Valley, although no sightings have been documented within the analysis corridor. It is also possible that the peregrine may be a rare visitor along this variation; no nesting is known to occur in the area. Three bald eagle winter roosts exist along Thistle Creek, but are outside of the analysis corridor [UDWR, unpublished data c].

Eleven Swainson's hawk nests lie within the analysis corridor [UDWR, unpublished data c]. Yellow-billed cuckoo habitat occurs within wooded riparian zones within the area of concern, but at present no nests are documented within the analysis corridor.

Table 3.3-14

IMPORTANT WILDLIFE HABITAT FEATURES,
WEST STRAWBERRY VARIATION

Milepost	Wildlife Concerns
4.4-17.9	Sage Grouse - high priority nesting
4.4-20.3	Raptor concentration
5.4-6.3	Elk - critical calving area
7.6-8.6	Elk - critical calving area
13.0-14.9	Elk - critical calving area
17.0-22.1	Mule Deer - high priority winter range
18.0-20.4	Elk - critical calving area
26.4-27.3	Mule Deer - high priority winter range
27.0-27.8	Elk - critical winter range
27.6-30.2	Mule Deer - critical winter range
29.4-31.0	Mule Deer - high priority winter range
42.1-43.3	Elk - critical calving
43.3-48.8	Elk - critical winter range
44.4-48.9	Mule Deer - critical winter range
51.6-55.8	Mule Deer - high priority winter range
56.2-58.0	Elk - high priority winter range
59.2-62.3	Mule Deer - critical winter range

3.3.2.7.3 Grazing

Sixteen livestock grazing allotments would be intersected by the West Strawberry Variation. These allotments, under FS jurisdiction, range from 1,627 to 115,039 acres in size. The permanent range is grazed primarily by sheep.

3.3.2.8 Socioeconomics

3.3.2.8.1 Traffic

The variation begins in Wasatch County, Utah, and runs south through Utah; it rejoins the mainline east of Nephi in Sanpete County. Access between Chipman Creek (MP 18.5) and U.S. Highway 89 near Indianola (MP 47.0) is limited to recreational roads and U.S. Highway 6 (MP 28). These recreational roads are unsuitable for use by heavy equipment. In many areas there are no roads. There is also no or limited access between Browns Peak (MP 42) and to the NF boundary (MP 44.5). Table 3.3-15 shows the crossing data. No vehicular travel is permitted off existing travelways within the Uinta and Manti-LaSal National Forests in areas crossed by this variation.

Table 3.3-15

TRANSPORTATION CORRIDOR CROSSINGS, WEST STRAWBERRY VARIATION

State/County	U.S. Interstate	U.S. Federal	State	County & Local
UTAH				
Wasatch	I-40	-	-	10+
Utah	I-6	-	-	10+
Sanpete	-	US 89	UT 132	15+

3.3.2.8.2 Noise

The West Strawberry Variation would replace sections of the north-central portions of the primary route and would have approximately the same ambient noise levels as those projected for the proposed action (refer to Table 3.1-20). The West Strawberry Variation would have projected ambient noise levels ranging from 35 to 50 dBA. The area surrounding the West Strawberry Variation represents primarily undeveloped rural land. No compressor stations would be located along the West Strawberry Variation and therefore no list of sensitive noise receptors is needed.

3.3.2.8.3 Recreational Resources

The route enters the Uinta National Forest near MP 6.5 and exits near MP 28. Near MP 11 is an important developed recreation area on both private and forest lands on the west side of Strawberry Reservoir. Approximately .5 mile east of the proposed route are several camps, a campground, boat ramps, and a Forest Service station. A residential area, Bryants Fork Summer Home Area, is approximately .5 mile west of the corridor centerline.

At Bryant's Fork Summer Home Area there are cabins, driveways, and the principal access road to the recreation facilities nearer the Reservoir. The Strawberry Recreation Area is of regional importance for Utah and the nearby western states; use on a typical summer weekend exceeds 40,000 people. Besides boating, there is camping, fishing and hiking. Off-road vehicle use is not permitted in the Recreation Area and immediately surrounding areas. The proposed route parallels the main access road to the entire complex.

The dispersed recreation opportunities along this variation are similar to those discussed in Section 3.1.8.4. The Recreation Opportunity Spectrum (ROS) classes for the route include seven miles of Semiprimitive Motorized, seven miles of Roaded Natural, seven miles of Rural, and five miles of Semiprimitive Nonmotorized. Vehicle use is not permitted off existing travelways.

No other designated recreational resources are within the corridor in the Manti-LaSal National Forest, between MP 31 to 41. Within these mileposts the route parallels Skyline Drive, considered by the Utah Travel Council as a "panorama and motor tour" which offers spectacular panoramic views of the landscape. As a consequence, this road is heavily traveled by visitors. The route of the variation also parallels Browns Peak Road. Dispersed recreation opportunities are similar to those discussed in Section 3.1.8.4. The ROS class on the Manti-LaSal is Roaded Natural. Vehicle use is not permitted off existing travelways. No other recreational resources are within the study area for the remainder of the variation.

3.3.2.9 Land Ownership/Use

The proposed West Strawberry Variation begins at approximately MP 119 of the mainline route in Wasatch County, Utah. It crosses approximately 1.5 miles of agricultural land along the Strawberry River. The Wasatch County plan addresses the land use in Strawberry Valley as: "the need in Strawberry Valley is to avoid permanently injuring the ecology while allowing judicious development of the area's scenic and recreational resources to take place". The present land use is forest and grazing. From about MP 6.5 the proposed route would enter the Uinta National Forest; this route is not in a designated utility corridor (see comments in Section 3.1.9).

In Utah County the proposed variation is still in the Uinta National Forest boundaries until approximately MP 28. The proposed route would pass within 0.5 mile of a restaurant located next to U.S. Highway 6. At approximately MP 31.0 the variation would enter the Manti-LaSal NF for the next 10 miles. This is not in a Forest Service designated utility corridor, and therefore not in conformance with the Forest plan. Mileposts 31-39 are located in an unclassified area regarding utility corridor planning. Utilities could pass through the area if mitigation measures were applied which would cause the proposed facility to meet prescribed standards and guidelines in the Forest Plan. The remaining two miles on the Manti-LaSal National Forest (MP 39-41) are classified as an avoidance area for utility corridor planning. This is an area where utility construction would cause environmental impacts that would be difficult or impossible to mitigate or where land characteristics impose unusual engineering constraints.

The variation then enters Sanpete County and ties back into the mainline at approximately MP 176.0. The land use is currently being subdivided for recreation residential use to MP 45, then the land use is grazing. (See Section 3.1.9 for county plans.)

Tables 3.3-16 and 3.3-17 show land ownership and land use by county, respectively, for the West Strawberry Variation. Refer to Table 3.1-24 for rules, regulations, and policies of the administrative agencies for the variations.

Table 3.3-16

LAND OWNERSHIP, WEST STRAWBERRY VARIATION

	Miles and Percent in Utah Counties			
	Wasatch	Utah	Sanpete	TOTAL
Private	8.6 (38)	3.2 (14)	17.0 (90)	28.8 [45]
BLM	-	-	1.8 (10)	1.8 [3]
FS	13.9 (623)	19.5 (86)	-	33.4 [52]
TOTAL	22.5	22.7	18.8	64.0

Table 3.3-17

LAND USE, WEST STRAWBERRY VARIATION

	Miles and Percent in Utah Counties			
	Wasatch	Utah	Sanpete	TOTAL
Grazing/ Rangeland	7.6 (34)	3.2 (14)	18.8 (100)	29.6 [46]
Timber/ Forestland	13.9 (62)	19.5 (86)	-	33.4 [52]
Irrigated/ Non-Irrigated Agiculture	1.0 (4)	-	-	1.0 [2]
TOTAL	22.5	22.7	18.8	64.0

3.3.2.10 Cultural Resources

3.3.2.10.1 Archaeology

The cultural resources situated within the mile-wide analysis corridor for this variation were studied in the same way as was done for the Kern River proposal discussed in Section 3.1.10.

The West Strawberry Variation is about 64 miles in length. Only two surveys have been conducted within or partially within the analysis corridor. These two surveys covered about 0.25 mile (0.4 percent) of the proposed pipeline construction ROW.

Seven sites are documented within the mile-wide analysis corridor. The six prehistoric sites consist of four lithic scatters, a burial, and a village site. The single historic site consists of a military target area and associated trail used by General Johnson of the Federal Army in 1857.

No sites are listed on or are eligible for the National Register.

3.3.2.10.2 American Indian Concerns

This variation falls within the traditional ethnographic use areas of the Ute Indian Tribe of Utah. Their particular concerns have been discussed in Section 3.1.10.2.

3.3.2.11 Paleontological Resources

Table 3.3-18 provides information on the paleontological formations found along the West Strawberry Variation.

Table 3.3-18

PALEONTOLOGICAL FORMATIONS, WEST STRAWBERRY VARIATION

Age	Formation	Potential 1/ Vertebrate/ Invertebrate	Sensitivity
Quaternary	Quaternary alluvium	H/M	Yes
Pennsylvanian	Oquirrh Formation	M/H	No
Paleocene-Eocene	Colton Formation	H/L	Yes
Eocene	Uinta Formation	H/L	Yes
Eocene	Green River Formation	H/H	Yes
Paleocene-Eocene	Flagstaff Formation	M/H	No
Cretaceous-Paleocene	North Horn	H/M	Yes
Eocene	Crazy Hollow	unknown	I.D.
Oligocene	Moroni Volcanics	L/L	No

1/ L = Low, M = Moderate, H = High

3.3.2.12 Visual Resources

Refer to Section 3.1.12 for methodology.

MP 4.8-24.7, VRM/VQO: FS Class R, PR, M
Description: Uinta National Forest. The landform consists of mountainous terrain along ridgelines below peaks to 9,000 feet. The vegetation includes higher elevation pine forests on north slopes, valley aspen groves and sagebrush plant communities. Modifications include Highways 6, 50, and 89, Denver and Rio Grande Western railroad tracks, camp sites, guard stations, jeep trails, and access roads. The route is adjacent to the Strawberry Reservoir. The Uinta National Forest has categorized the scenic resources within National Forest System lands. The predominant visual quality objectives in the analysis corridor are Retention and Partial Retention. The scenic variety is predominantly Classes A and B. Critical viewpoint concerns are along the Forest roads, trails, and at developed recreation sites that parallel or are crossed by the route and the crossings of Interstates 40 and 6.

MP 29.1-43.2, VRM/VQO: FS Class PR
Description: Manti-LaSal National Forest. The landform consists of mountainous terrain divided by small canyons and several prominent peaks. The vegetation includes higher elevation pine forests on north slopes, valley aspen groves and sagebrush plant communities. National Forest features include Mill Fork Ridge, Poison Ridge, Bear Peak, Browns Peak, and Jones Ridge. Modifications in the Manti-LaSal National include hiking trails, Forest Service roads (#219), Skyline Drive, and Browns Peak Trail. The Manti-LaSal National Forest has categorized the scenic resources within National Forest System lands. The scenic variety is predominantly Class B. There are critical viewpoint areas associated with Skyline Drive and US Highway 89.

The visual resources on the Manti-LaSal National Forest are addressed by two management plans. The existing Multiple Use Management Plan shows the linear area of the variation as a travel influence zone. The draft Land and Resource Management Plan shows the linear area as Partial Retention (PR) which requires protection of ethestic values. When this Plan becomes final, it will supersede the Multiple Use Management Plan.

3.3.3 Salt Creek Canyon Variation

3.3.3.2 Geology

The Salt Creek Canyon Variation begins within the Middle Rocky Mountains Region near its western border and ends approximately 13.4 miles later in southern Juab Valley, about three miles west of Levan.

This variation begins within Nephi Canyon and traverses along the footslopes of a north-facing mountain on Jurassic age shales. The terrain is rugged and steep with a badlands appearance in many areas. Comments made with regards to the Middle Rocky Mountains around Nephi, Utah, in Section 3.1.2.2 also apply to the Salt Creek Canyon Variation. The Wasatch Fault would be closer to Nephi than along the primary route. The geology and physiography of the Salt Creek Canyon Variation is summarized in Table 3.3-19.

Table 3.3-19

GEOLOGIC AND PHYSIOGRAPHIC CONDITIONS,
SALT CREEK CANYON VARIATION

	MP 0-13.4
Geo/Phys Province	Middle Rocky Mountains/ Basin and Range
Geologic Unit	Sedimentary rock, volcanics, lacustrine sediments
Age	Jurassic
Topography	Very high relief, steep rugged slopes gently sloping alluvial deposits
Comments	Large scale landslides, faults, saturated valley floors

3.3.3.3 Soil

The proposed Salt Creek Canyon Variation would lie mostly within the Basin and Range region of Utah (MP 0-14) and would traverse predominantly deep soils on fans, terraces and plains. Topography is mostly level to rolling, with some moderate slopes on alluvial fans. Soil susceptibility to water and wind erosion is low to moderate. Reclamation potential is good to fair. Rock fragments are the primary limiting factors [SCS, 1984]. See Appendix A for a detailed description of the soil mapping units along the route of this variation and the milepost at which they would occur.

3.3.3.4 Surface Water

The Salt Creek Canyon Variation would occur marginally in the Middle Rocky Mountains Region and in the Basin and Range Region. Construction would occur totally within the Jordan River basin.

Only Salt Creek, which is a perennial stream with high sensitivity, would be crossed. The surface water resources that would be encountered along this variation would be similar to those described for the Middle Rocky Mountains and Basin and Range regions in Sections 3.1.4.2 and 3.1.4.3, respectively.

3.3.3.5 Groundwater

Approximately half of the Salt Creek Canyon Variation would lie within the mountainous portion of the Middle Rocky Mountains region. The remainder of the variation would lie within the alluvial valley portion of the Basin and Range region. General groundwater conditions in this area are as previously described for the proposed mainline. Specific conditions are listed in Table 3.1-8 for the Kern River mainline for MP 60-180.

3.3.3.6 Freshwater Biology

All drainages that would be crossed by the Salt Creek Variation lie within the Basin and Range region. Commonly occurring species of this region are listed in Table 3.1-12. One perennial stream, Salt Creek, would be crossed by this section of the pipeline. Salt Creek is rated as a Class B stream overall and is considered a high priority cold water trout stream by the State of Utah. No species of special concern are known to occur along the route.

3.3.3.7 Terrestrial Biology

3.3.3.7.1 Vegetation

General Vegetation. This variation would traverse both the Middle Rocky Mountains (MP 0-3) and the Basin and Range (MP 3-14) regions. Within the Middle Rocky Mountains only the mountain brush type would be crossed, and in the Basin and Range region only agricultural land would be traversed. These types are described in Appendix B.

Plant Species of Concern. No federally listed or federal candidate species are known to occur along the route.

3.3.3.7.2 Wildlife

General Wildlife. The Salt Creek Canyon Variation would cross only two vegetation communities: mountain brush and agricultural land. Wildlife commonly associated with these vegetation communities have been described under the Middle Rocky Mountains and Basin and Range regions of the Kern River mainline.

The ROW would traverse critical deer winter range for the first mile, but the analysis corridor would be within this habitat for an additional four miles [UDWR, unpublished data c].

The high relief of the San Pitch Front overlooking the vast open Juab Valley provides ample habitat for raptors common to the area. Three golden eagle nests have been identified within the analysis corridor [UDWR, unpublished data c].

Wildlife Species of Special Concern. The bald eagle and peregrine falcon, all federally listed endangered species, could potentially occur along this alignment, although no nests or roosts have been documented within the analysis corridor.

Federal candidate species potentially present include ferruginous hawk, Swainson's hawk, long-billed curlew and yellow-billed cuckoo. There is available habitat for these species within the analysis corridor, but no nests have been presently documented for the area of concern.

3.3.3.7.3 Grazing

Grazing along the proposed Salt Creek Canyon Variation occurs on private land for which detailed grazing information is not available.

3.3.3.8 Socioeconomics

3.3.3.8.1 Traffic

This variation route runs southwestward on more level terrain south of Nephi. It rejoins the mainline at a crossing of the Union Pacific railroad. It would cross UT 41 and more than 25 county and local roads.

3.3.3.8.2 Noise

The Salt Creek Canyon Variation of the proposed Kern River Pipeline proposal would replace a small portion of the central region of the proposed primary route between MP 180 and 192. Projected ambient noise levels in this variation would be slightly higher than the portion of the route it would replace. The Salt Creek Canyon Variation would go through an industrial area, divert around Nephi, Utah, and would parallel a railroad line. These factors would all contribute to a projected ambient noise level of between 50 and 65 dBA. No compressor stations would be located on the Salt Creek Canyon Variation, and therefore pipeline construction related noise would represent a temporary situation.

3.3.3.8.3 Recreational Resources

No designated recreational resources are within the mile-wide corridor.

3.3.3.9 Land Ownership/Use

The entire Salt Creek Canyon Variation lies in Juab County, Utah. (See Section 3.1.9 for county discussion.) It proposes to leave the main route at approximately MP 180, and continues west through Salt Creek Canyon. At the mouth of this canyon a rock quarry is within 0.5 mile of the route. It then skirts the southeastern edge of the city of Nephi which has zoning regulations. The proposed route would then be in the Juab Valley paralleling existing railroad tracks to its termination at MP 192 of the main routing. The land use in the valley is scattered agriculture.

Tables 3.3-20 and 3.3-21 depict land ownership and land use by county for this variation. Refer to Table 3.1-24 for rules, regulations, and policies of the administrative agencies for the variations.

Table 3.3-20

LAND OWNERSHIP, SALT CREEK CANYON VARIATION

	Miles and Percent for Juab County, Utah	TOTAL
Private	14.0 (100)	14.0 (100)

Table 3.3-21

LAND USE, SALT CREEK CANYON VARIATION

	Miles and Percent for Juab County, Utah
Grazing/ Rangeland	11.5 (82)
Commercial/ Residential	0.5 (4)
Residential	2.0 (14)
TOTAL	14.0

3.3.3.10 Cultural Resources

3.3.3.10.1 Archaeology

The cultural resources situated within the mile-wide corridor for this variation were studied in the same way as was done for the Kern River proposal discussed in Section 3.1.10.

The Salt Creek Canyon Variation is about 14 miles long. Three surveys have been conducted within or partially within the mile-wide analysis corridor. Three miles of these surveys were adjacent to (or perhaps partially covering) the proposed pipeline construction ROW.

No prehistoric cultural resource sites have been documented for the mile-wide analysis corridor. However, a comprehensive study has been undertaken of historic structures within the town of Nephi which lies just to the northwest of the proposed pipeline centerline. Three sites have been listed on the National Register: the Edwin Robert Booth House (Site JB16A 12 2), the George Carter Whitmore building (Site JB16A 21 4), and the Oscar M. Booth House (Site JB16A 32 1). The latter site lies just outside the mile-wide analysis corridor. In addition, another 610 historic structures in Nephi have been evaluated as potentially eligible for the National Register [David Schirer, Utah Division of State History, 1986, personal communication]. It is not known how many of these are located within the analysis corridor. Finally, one or more petroglyph sites have been reported (but not recorded) just northeast of Nephi. They are apparently located within the mile-wide analysis corridor.

This short variation has been assigned a high sensitivity rating.

3.3.3.11.2 American Indian Concerns

No specific American Indian concerns have been identified for this variation.

3.3.3.11 Paleontological Resources

The Salt Creek Canyon Variation would encounter the Jurassic Age Arapien Shale and Quaternary alluvium. Insufficient data are available to make a determination of the significance of the formations.

3.3.3.12 Visual Resources

No areas of potential scenic and visual significance have been identified for this alternative.

3.3.4 North Las Vegas Variation (with the Goodsprings Spur)

3.3.4.2 Geology

The proposed North Las Vegas Variation would be located in the Basin and Range province. The topography varies from broad, flat alluvial fans and basin terrain in the Dry Lake, Las Vegas, and Ivanpah Valleys to the steep and rugged pass through the Bird Spring Range. The proposed route crosses the Las Vegas Shear Zone, a right-lateral fault and passes to the east of the Keystone thrust fault [Stewart and Carlson, 1978; Bell, 1981]. Slope instabilities may exist locally along the route within the Bird Spring Range, but it is generally unlikely due to the arid climate. Ground subsidence has occurred in the Las Vegas Valley due to groundwater overdrafting [Bell, 1981]. No unique geologic features exist along the proposed route [Bell, 1981]. Gold, silver, copper, lead, and zinc deposits occur in the Spring Mountains, which are to the west of the proposed route [Nevada Bureau of Mines, 1964]. The geology and physiography of the North Las Vegas variation is summarized in Table 3.3-22.

Table 3.3-22

GEOLOGIC AND PHYSIOGRAPHIC CONDITIONS, NORTH LAS VEGAS VARIATION

	Valley between Muddy Mtns. and Arrow Canyon Range (MP 0-50)	Las Vegas Valley (MP 55-100)	Goodsprings Valley to Ivanpah Valley (MP 100-121.1)
Geo/Phys Province	Basin & Range	Basin & Range	Basin & Range
Geologic Unit	Alluvium, sedimentary rocks, playa lake basin	Alluvium, sedimentary rock	Alluvium
Age	Quaternary	Quaternary	Quaternary
Topography	low to moderate relief, flat to moderately steep slopes	low to moderate relief, low to moderate steep slopes	low relief, gentle to flat slopes
Comments	Unconsolidated to poorly consolidated alluvial and playa basin deposits, well consolidated sedimentary rock	Unconsolidated to poorly consolidated alluvial deposits, sedimentary rock	Unconsolidated to poorly consolidated alluvial deposits

3.3.4.3 Soil

The proposed North Las Vegas Variation, within the Mojave Desert region of Nevada (MP 0-109), predominantly traverses intermingled deep soils and shallow soils with hardpans on alluvial fans, terraces and pediments. Shallow soils on mountains and foothills are not extensive. Topography is mostly level to rolling, with a few steep slopes on mountains. Soil susceptibility to water erosion is mostly low, and only ranges to high on a few steep slopes. Wind erosion potential is mostly low to moderate, but ranges to high on areas with sandy soils. Reclamation potential is mostly poor. Soil depth, rock fragments, sandy texture, salinity, and alkalinity are the primary limiting factors [SCS, 1977a, 1977b, 1985a]. See Appendix A for a detailed description of the soil mapping units along the route of this variation.

3.3.4.4 Surface Water

The North Las Vegas Variation would be located in the Mojave Desert Region. The character of the water resources within the Mojave Desert province along this variation route was previously described in Section 3.1.4.4. Approximately nine intermittent and numerous ephemeral drainage channels (Table 3.3-23) would be crossed by the variation.

Table 3.3-23
MAJOR DRAINAGE CHANNELS, NORTH LAS VEGAS VARIATION

Drainage Basin	Drainage Channel	Class[1] Flow	Sensitivity[2] Channel Bed	Sensitivity[2] Side Slope	MP
Colorado River	Weiser Wash	I-P	L	L	6.1
	Meadow Valley Wash	I	-	-	11.4
	Muddy River	I-P	L	L	16.7
	Unnamed	I	-	-	21.8
	Unnamed	I	-	-	26.0
	Unnamed	I	-	-	46.5
	Unnamed	I	-	-	76.8-84.0
	Red Rock Wash	I	-	-	84.2
	Unnamed	I	-	-	91.2
	Unnamed	I	-	-	110.3
	Unnamed	I	-	-	120.9
	Unnamed	I	-	-	121.9
	Unnamed	I	-	-	130.2

---

[1] I = intermittent, P = perennial, - = ditch or canal

[2] Sensitivity
Channel Bed Gradient:
L = low 0-1% M = moderate 1-3% H = high > 3%
Sideslope (topographic slope):
L = low 0-5% M = moderate 5-20% H = high > 20%

3.3.4.5 Groundwater

General groundwater conditions in the vicinity of the North Las Vegas Variation are similar to those described for the alluvial valley region of the Basin and Range province. General groundwater conditions in this area are the same as those described for the proposed mainline. Specific conditions are listed in Table 3.1-8 for the Kern River mainline for MP 410-530.

3.3.4.6 Freshwater Biology

General Freshwater Biology. All drainages that would be crossed by the North Las Vegas Variation lie within the Mojave Desert region. Numerous small ephemeral washes as well as several larger intermittent washes and one marginally perennial stream would be crossed by this section of the pipeline. Aquatic habitats, for the most part, tend to be ephemeral in nature and utilized by organisms with short, opportunistic life cycles and capable of withstanding desiccation such as some algae and insects. One drainage that would be traversed within this region supports a Class B fishery. This relatively high rating is derived primarily from the presence of several sensitive nongame species in upstream areas.

Aquatic Species of Special Concern. The same species of concern described in Section 3.1.6.4 occur along this variation.

3.3.4.7 Terrestrial Biology

3.3.4.7.1 Vegetation

General Vegetation. The North Las Vegas Variation (MP 0-109) would traverse Mojavean creosote bush scrub, wetland/riparian, and desert saltbush scrub, all within the Mojave Desert. These types are described in Appendix B and their distributions along the variation route are listed in Table 3.3-24.

Plant Species of Special Concern. Five federal candidate species including one Nevada state designated endangered species, wild buckwheat, may occur in areas that would be traversed by the variation route. Appendix C describes these species and their habitat.

Table 3.3-24

VEGETATION COMMUNITY TYPES, NORTH LAS VEGAS VARIATION

Geographic Region	Community Type	Milepost
Mojave Desert	Mojavean Creosote Bush Scrub	0-8
	Wetland/Riparian	8-9
	Mojavean Creosote Bush Scrub	9-12
	Wetland/Riparian	12-13
	Mojavean Creosote Bush Scrub	13-34
	Desert Saltbush Scrub	34-35
	Mojavean Creosote Bush Scrub	35-109

3.3.4.7.2 Wildlife

General Wildlife. The North Las Vegas Variation would traverse three vegetation communities: creosote bush scrub, saltbush scrub, and riparian zones of the wetland community. Characteristic wildlife commonly occurring in each of these communities have been described for the Mojave Desert region in Section 3.2.7.1.

Potential raptor nesting habitat is available throughout the area where cliffs, rock outcrops and other high relief features occur.

Wildlife Species of Special Concern. Two federally listed endangered species potentially occur within the vicinity: peregrine falcon and bald eagle. Both species occur in the area only as rare migrants, and no specific sites of occurrence have been identified within the analysis corridor.

Besides being listed as a federal candidate species, the Gila monster is also considered a Nevada state rare species. It is an uncommon inhabitant of sandy washes in southern Nevada [BLM, 1985b]. Although uncommon, available habitat does exist over most of the proposed analysis corridor, but no specific sites within the area of concern have been delineated as sensitive habitat.

The desert tortoise is a federal candidate species for listing and a Nevada state rare species. The tortoise occurs throughout the Mojave Desert region primarily in creosote bush scrub and Joshua tree woodlands at lower elevations [BLM, 1985b]. Although populations occur throughout the province, they are scattered and vary in density according to local habitat conditions. Tortoise populations and habitat sites have been identified through the BLM [1982]. Because the tortoise and its habitat is sensitive to harassment, exact locations of these sites are not given in this document. In Nevada three crucial habitat sites (>40 tortoise per square mile) are crossed by the proposed route for a total of 33 miles. This includes the Arrow Canyon, Red Rock and Goodsprings sites.

Desert bighorn sheep occur within the mountain ranges of southern Nevada. Populations within these areas have been declining in recent years due to the increase in recreational sites within these mountain ranges, overgrazing by domestic stock and disease [Tsukamota, 1975]. The proposed pipeline would cross or run adjacent to potential desert bighorn habitat for a total of approximately 19 miles.

Feral horses and wild burros occur within the Spring Mountain Range [BLM, 1982]. The majority of these animals occur within the Blue Diamond and Red Rock Canyon Recreation area and this habitat would be crossed by the proposed ROW for nine miles. Wild horses are also present in the Bird Spring Range; six miles of this habitat lies within the analysis corridor.

Although Swainson's and ferruginous hawks may be common winter residents in the area, they are unlikely breeders in the general vicinity of the alignment [BLM, 1985b].

The yellow-billed cuckoo is a federal candidate species. At present the cuckoo is thought to occur in the area only as a rare migrant [BLM, 1985b].

The western snowy plover potentially nests within the vicinity of the proposed route on alkali flats. No nesting sites have been identified along the analysis corridor.

A list of all wildlife species discussed for this variation is presented as Appendix E-2.

3.3.4.7.3 Grazing

The Kern River North Las Vegas Variation would intersect seven BLM livestock grazing allotments which vary in size from 14,986 to 310,364 acres. These allotments are mostly ephemeral with cattle as the primary livestock.

3.3.4.8 Socioeconomics

3.3.4.8.1 Traffic

The variation originates near MP 439 north of the Moapa valley and parallels the mainline southwestward in Clark County, Nevada. It rejoins the mainline route at the Nevada-California boundary. Table 3.3-25 shows the crossing data.

Table 3.3-25
TRANSPORTATION CORRIDOR CROSSINGS, NORTH LAS VEGAS VARIATION

State, County	US Federal	State	County & Local	RR 1/
NEVADA				
Clark	US 93, 95	UT 53,160 168	10+	UP (2)

1/ UP = Union Pacific (crosses twice)

3.3.4.8.2 Noise

This variation would replace a major portion of the primary route in Nevada. Projected ambient noise levels in this variation would remain essentially similar to those of the proposed primary route. The North Las Vegas Variation has projected ambient noise levels which would range from 35 to +80 dBA. The +80 dBA levels would be associated with predicted readings adjacent to the proposed Compressor Station No. 5.

Projected ambient noise levels along the variation would be similar to the primary route up to MP 495. At this point the North Las Vegas Variation would run through essentially undeveloped rural areas which would have ambient noise levels in the 35 to 40 dBA range.

Since the proposed Compressor Station 5 along the Goodsprings Spur has not been firmly located, it is impossible to determine exact areas of noise sensitive receptors. It is presumed that the compressor station would be located within the Goodsprings Valley.

3.3.4.8.3 Recreational Resources

The North Las Vegas Variation route passes west of Las Vegas; between MP 95 and 98.5 it transects Off-Road Vehicle Recreation Area 13 on public (BLM) lands in Clark County, Nevada, west of the town of Goodsprings and east of Interstate 15. The season of use is October through April, and vehicles and competitive ORV use are confined to existing roads, courses, trails, and sand washes [Clark County Management Framework Plan, BLM, 1983; 334]. Three events are allowed within the winter season, but thusfar none have been held. A special use permit is required [Mellington, 1986].

3.3.4.9 Land Ownership/Use

The North Las Vegas Variation using the Goodsprings Spur would leave the mainline at approximately MP 438 and would traverse approximately one mile of SCS-designated prime farmland between MP 0-1. This variation is located totally in Clark County, Nevada. The Bureau of Land Management (BLM) land is leased for grazing until approximately MP 57. Between MP 63 to 68 the proposed variation would be within 100 feet of approximately 10 homes. From MP 68 to 74 the proposed variation would traverse the Husite Development currently under plan by Howard Hughes Properties. The "proposed alignment would cause great havoc and disruption to the planned villages on our property" [Bonar, 1986]. In the Moapa Valley around the Muddy River the private land is used for irrigated agriculture. The proposed variation would cross approximately one mile of land which is also SCS prime farmland. The route would enter the Moapa Indian Reservation at MP 14.5 and traverse approximately 15 miles of grazing land. Between MP 28-35 the pipeline would cross a little over five miles of SCS prime farmland; the present land use is grazing. The route enters Nellis Air Force Base with about three miles of the next five miles being within its boundary. The land is currently being used as a small arms range; under study is a proposal to change the land use to that of training of armored vehicles. The area is now closed to public access. From MP 57-70 the land use is residential. The land use for the rest of the line is grazing except between MP 81-82 (residential) and 95-98.5 (Off-Road Vehicle Recreation Area 13). From MP 98.5-111 is rangeland within a designated Desert Tortoise Habitat area. This variation would join the mainline at approximately MP 534. The BLM Clark Resource Area has no designated utility corridors (see Section 3.1.9 for comments).

Tables 3.3-26 and 3.3-27 depict land ownership and land use by county. Refer to Table 3.1-24 for rules, regulations, and policies of the administrative agencies.

Table 3.3-26

LAND OWNERSHIP, NORTH LAS VEGAS VARIATION

	Miles and Percent for Clark County, NV
Private	20.9 (19)
BLM	71.0 (65)
DOD	3.0 (3)
Indian	14.3 (13)
TOTAL	109.0

Table 3.3-27
LAND USE, NORTH LAS VEGAS VARIATION

	Miles and Percent for Clark County, NV
Grazing/ Rangeland	87.0 (80)
Irrigated/ Non-Irrigated Agricultural	1.0 (1)
Residential	18.0 (16)
Other (DOD)	3.0 (3)
TOTAL	109.0

3.3.4.10 Cultural Resources

3.3.4.10.1 Archaeology

The North Las Vegas Variation (with the Goodsprings Spur) is about 109 miles long. At least 80 surveys have been conducted within or partially within the analysis corridor, including the Overthrust Pipeline survey (2.75 miles) and the Dry Lake Valley survey (8.65 miles). These surveys covered about 18.6 miles (17.1 percent) of the proposed construction ROW, It is not certain, however, whether the entire Dry Lake Valley survey was done to BLM standards. In addition, about 37 miles of other surveys were done directly adjacent to (perhaps partially covering) the ROW. The latter include the Navajo McCullough survey (23.5 miles), various seismic line surveys (9.75 miles) and the El Dorado/Kaiparowits survey (three miles).

There are 73 known sites situated within the analysis corridor of the North Las Vegas variation. These include 60 prehistoric and 13 historic sites. Prehistoric sites include five habitation sites with roomblocks, 20 lithic scatters, a cave, eight rockshelters, a rock alignment, and two quarry sites. Other sites include five rock rings with associated lithics and 12 isolated finds. Historic sites include a railroad grade, a railroad gate, a telephone line, two railroad camps, two historic trail markers, and other historic camps and trash sites. This variation passes through the middle of the Moapa River Indian Reservation, paralleling the IPP transmission lines.

No sites are listed on, or have been determined to be eligible for, the National Register for the entire North Las Vegas variation including the Goodsprings Spur. However, the two Old Spanish Trail Markers have been declared Nevada State Monuments.

There is one high sensitivity pipeline segment along this route.

3.3.4.10.2 American Indian Concerns

The North Las Vegas Variation passes through the middle of the Moapa River Indian Reservation for about 15 miles. The Moapa River Indians are particularly concerned about any pipelines crossing reservation lands due to general concerns for systems safety, harm to ancestral sites, erosion of tribal lands due to the effects of pipeline construction and the cutting of access roads, and possible land use conflicts since the tribe has plans to lease recently acquired lands to ordnance manufacturers. In addition there is concern for certain traditional ethnographic use areas crossed by the North Las Vegas Variation, particularly Dry Lake Valley [Stoffle and Dobyns 1982; 184] and the Moapa Valley [Stoffle et al. 1983; 144].

3.3.4.11 Paleontological Resources

Table 3.3-28 provides information on the paleontologically important formations traversed by the North Las Vegas Variation.

Table 3.3-28

PALEONTOLOGICAL FORMATIONS, NORTH LAS VEGAS VARIATION

Age	Formation	Potential [1] Vertebrate/ Invertebrate	Sensitivity
Quaternary	Quaternary alluvium	H/L	Yes
Pliocene	Muddy Creek Formation	L/H	No
Permian-Pennsylvanian-Permian	Bird Spring Group	L/H	No
Permian	Kaibab/Toroweap Formations	M/M	No

---

[1] L = Low, M = Moderate, H = High

3.3.4.12 Visual Resources

No areas of potential scenic and visual significance have been identified for this alternative.

3.3.5 Henderson Variation

3.3.5.2 Geology

The proposed Kern River Henderson Variation would lie in the Basin and Range Region (MP 0-15). The topography is characterized by low relief and gentle slopes. The geology consists of Quaternary alluvial fan deposits and tuffaceous sedimentary rocks [Stewart and Carlson, 1978]. The proposed route crosses the Quaternary age Whitney Mesa fault [Weide, 1982a, 1982b; Nakata et al., 1982]. No slope instabilities are shown on published geologic maps [Stewart and Carlson, 1978]. Subsidence has occurred since 1946 due to groundwater overdrafting in the Las Vegas Valley [Bell, 1981]. No unique geologic features occur along the proposed route [Bell, 1981]. No mineral or petroleum resources exist along the proposed route [Nevada Bureau of Mines, 1964].

3.3.5.3 Soil

The proposed Henderson Variation would cross the Mojave Desert region of Nevada (MP 0-15), predominantly traversing intermingled deep soils and shallow soils with hardpans on alluvial fans. Topography is mostly level to sloping. Soil susceptibility to water erosion and wind erosion potential are mostly low. Reclamation potential is mostly poor. Soil depth, rock fragments, sandy texture, salinity and alkalinity are the primary limiting factors [SCS, 1977a, 1977b, 1985a]. See Appendix A for a detailed description of the soil mapping units along the route of this variation and the milepost at which they would occur.

3.3.5.4 Surface Water

The Henderson Variation would lie within the Las Vegas Wash watershed; however, the variation would not cross the wash. Approximately 15 ephemeral drainage channels would be crossed by the variation. The characteristics of the water resources along this variation were previously described in Section 3.1.4.4 of the Kern River Proposal. No significant water resources occur along the variation route.

3.3.5.5 Groundwater

General groundwater conditions in the area of the Henderson Variation are similar to those described for the alluvial valley region of the Basin and Range province. General groundwater conditions in this area are as previously described for the proposed mainline. Specific conditions are listed in Table 3.1-8 for the Kern River mainline for MP 410-530.

3.3.5.6 Freshwater Biology

The Henderson Variation would lie within the Mojave Desert region. No perennial streams would be crossed by this variation. Several small unnamed washes would be traversed, but none support any significant aquatic resources. No species of special concern occur in any of the drainages that would be crossed by this variation.

3.3.5.7 Terrestrial Biology

3.3.5.7.1 Vegetation

General Vegetation. This variation would traverse only Mojavean creosote bush scrub in the Mojave Desert between MP 0-15. This type is described in Appendix B.

Plant Species of Special Concern. Five federal candidate species, including wild buckwheat, which is also a Nevada state designated endangered species, may occur in areas that would be traversed by the variation route. Appendix C describes these species and their habitat.

3.3.5.7.2 Wildlife

General Wildlife. Common wildlife species associated with this creosote bush scrub community are described under the Mojave Desert region of the mainline.

Wildlife Species of Special Concern. No federally listed threatened or endangered species occur along the proposed route.

The Gila monster is a federal candidate and Nevada state rare species which may occur throughout the area, particularly within rocky or sandy washes. Preferred habitat is limited in this area, and no sensitive habitat sites have been delineated.

The desert tortoise is also a federal candidate and Nevada state rare species potentially occurring throughout the creosote scrublands. No crucial habitat has been identified within the analysis corridor.

The western snowy plover is a federal candidate species that utilizes alkali flats for nesting. Although no nesting has been documented within the analysis corridor, the potential exists where such alkali flats are intersected by the proposed route.

3.3.5.7.3 Grazing

The Kern River Henderson Variation would intersect only private land for which grazing information is unavailable.

3.3.5.8 Socioeconomics

3.3.5.8.1 Traffic

This short segment leaves the mainline northwest of Henderson, Nevada, and runs southwest until it rejoins the mainline southwest of Henderson. Many of the crossings are streets in residential developments south of Las Vegas. The variation crosses state roads NV 46 and NV 152 and crosses more than 10 county and local roads.

3.3.5.8.2 Noise

The Henderson Variation of the proposed Kern River pipeline would replace a small section of the primary route within the town of Henderson, Nevada. Projected ambient noise levels in this variation would be equivalent to the portion of the route it would replace. Due to the urban and industrial nature of this portion of the route, projected ambient noise levels would range from 45 to 60 dBA. Since no compressor stations would be located on the Henderson Variation, and therefore pipeline construction related noise would represent a temporary situation.

3.3.5.8.3 Recreational Resources

The first portion of the proposed route passes through approximately .25 mile of the southern portion of the proposed Clark County Wetlands Park. Typical recreational activities would include nature study, sightseeing, and hiking.

3.3.5.9 Land Ownership/Use

The Henderson Variation leaves the mainline at approximately MP 496.1 and returns at approximately MP 509.1. Of the 15.3 mile distance, about one half is in the city limits of Henderson, Nevada. The route would be in the Stephanie Street 100-foot ROW. All of the route's land use is residential but coincides with Henderson Comprehensive Plan. The land is privately owned. Refer to Table 3.1-24 for rules, regulations, and policies of the administrative agencies.

3.3.5.10 Cultural Resources

3.3.5.10.1 Archaeology

The cultural resources situated within the mile-wide corridor for this variation were studied in the same way as was done for the Kern River proposal discussed in Section 3.1.10.

The Henderson Variation is about 15.3 miles long. Fourteen surveys have been conducted within or partially within the analysis corridor. The Bonanza Materials Sand and Gravel Lease Survey covered 1.5 miles (9.8 percent) of the proposed pipeline construction ROW. In addition, other surveys covered about 9.05 miles adjacent to (or perhaps partially covering) the proposed construction ROW. Surveys relating to improvements to SR 146 account for 8.5 of these miles.

Five cultural resource sites are documented for this analysis corridor. Four are isolated artifacts and the fifth is an historic dump. None of these sites are on the National Register and none have been declared eligible.

3.3.5.10.2 American Indian Concerns

No specific American Indian concerns have been identified for this variation.

3.3.5.11 Paleontological Resources

The Henderson Variation route passes through one formation, Quaternary alluvium, of the Quaternary Age, which has been determined to be highly significant.

3.3.5.12 Visual Resources

No areas of potential scenic and visual significance have been identified for this alternative.

3.3.6 North Bakersfield Variation

3.3.6.2 Geology

Geology and Physiography. The proposed North Bakersfield Variation would cross two major physiographic regions: the Tehachapi Mountains and the southern San Joaquin Valley. The topography varies from a very high relief area characterized by steep slopes within the Tehachapi Mountains to a more broad low to moderate relief with gentle slopes to flat areas in the southern San Joaquin Valley. The geology of this proposed route is characterized by Mesozoic granites in the Tehachapi Mountains and part of the Sierra Nevada Batholith and Quaternary fan and basin deposits with sedimentary rocks in the southern San Joaquin Valley [Smith, 1964]. The geology and physiography of the North Bakersfield variation is summarized in Table 3.3-29.

Faulting and Seismicity. The North Bakersfield Variation route has experienced the strong ground shaking associated with the

Table 3.3-29

GEOLOGIC AND PHYSIOGRAPHIC CONDITIONS, NORTH BAKERSFIELD VARIATION

Location	Geol/Phys Province	Geologic Unit	Age	Topography	Comments
Tehachapi Valley (MP 0-7)	Southern Sierra Nevada	Alluvium	Quaternary	Low relief, gentle slopes	Poorly consolidated rock
Tehachapi Mtns (MP 0-24)	Southern Sierra Nevada	Granite and sedimentary rocks	Mesozoic Quaternary	High relief, moderate to steep slopes	Moderately hard to hard rock
Southern Foothills of Greenhorn Mts (MP 25-55)	Southern Sierra Nevada	Sedimentary rock	Quaternary	High relief, moderate to steep slopes	Loosely consolidated shale and gravel deposits; moderate to well consolidated sandstones & shales
Southern San Joaquin Valley (MP 55-91.1)	Great Valley	Alluvial fans and sedimentary rock	Quaternary	Low to moderate relief, gentle to moderate slopes, also flats	Unconsolidated fan deposits loosely consolidated shale and gravel deposits
Buena Vista Hills Buena Vista Valley Temblor Valley (MP 91.1-111)	Great Valley	Sedimentary rock and alluvium	Quaternary Tertiary	Low relief, gentle slopes to flat	Unconsolidated to poorly consolidated material

1857 Fort Tejon earthquake and the 1952 Kern County earthquake (see Section 3.1.2.2 of Volume I). The proposed North Bakersfield Variation route crosses faults that have displayed movement in recent times. The White Wolf Fault and the Edison Fault would be crossed at MP 18 and 19 [Smith, 1964]. The White Wolf Fault shows displacement from the 1952 Kern County earthquake in the area that the proposed North Bakersfield route would cross [Jennings, 1975]. A series of faults occur along the proposed route between MP 30 and 40, where ground ruptures occurred during the 1952 Kern County earthquake [Smith, 1964; Jennings, 1975]. The proposed route also crosses the Kern Front Fault near MP 50 [Smith, 1964], where fault creep slippage has been observed [Jennings, 1975], and the Premier Fault (MP 53) which parallels Highway 65 [Castle et al, 1983]. In addition, an unnamed fault in the Elk Hills (MP 92) and the Buena Vista Fault (MP 109) would be crossed. Refer to Section 3.1.2.6.

Slope Stability. Tertiary deposits west of Caliente and north of the Edison Fault are prone to landsliding.

3.3.6.3 Soil

For a detailed description of the soil mapping units along the route of this variation and the milepost at which they would occur, refer to Appendix A.

3.3.6.3.1 Tehachapi Mountains (MP 0-33)

The portion of the proposed North Bakersfield Variation within the Tehachapi Mountains would predominantly traverse moderately deep and deep soils on sloping to steep mountainous uplands. Soils on short segments in mountain valleys are deep. Water erosion potential is mostly moderate to high on the mountains, and low to moderate in the valleys. Wind erosion potential is moderate. Reclamation potential is fair to poor on the mountains and is primarily limited by slope and soil depth. In the valleys reclamation potential is good to fair and is primarily limited by a few moderately steep slopes and areas with stones [SCS, 1967, 1981a, 1986f].

3.3.6.3.2 San Joaquin Valley (MP 33-111)

The portion of the North Bakersfield Variation route within the San Joaquin Valley traverses deep soils. The soils of the San Joaquin Valley region formed in material derived from a variety of igneous, metamorphic and sedimentary rocks, and often modified by water. Most soils have little horizon development, although a few have well developed subsoils. Some soils are saline and/or alkaline. Surface organic matter content is low to moderate. Soil fertility ranges from low to very high. Water erosion potential is mostly low. Wind erosion potential is mostly low to moderate. Reclamation potential is mostly good [SCS, 1967, 1981a, 1986f].

3.3.6.4 Surface Water

The North Bakersfield Variation would lie within the Tehachapi Mountains and the San Joaquin Valley provinces. The route is drained by streams in the Buena Vista Lake Basin. The route would cross approximately 21 intermittent, 14 irrigation canals and drains, numerous ephemeral channels, and the Kern River. Table 3.3-30 lists the channels that would be crossed by the variation as well as the milepost of crossing. The character of the water resources that occur along the route was previously described in Sections 3.1.4.5 and 3.1.4.6.

3.3.6.5 Groundwater

General groundwater conditions in the vicinity of the North Bakersfield Variation mainline and its associated laterals and facilities are similar to those described for the alluvial valley region of the Basin and Range province and the San Joaquin Valley of the proposed mainline. General groundwater conditions in this area are the same as previously described for the proposed mainline. Specific conditions are listed in Table 3.1-8 between MP 640-760.

3.3.6.6 Freshwater Biology

One perennial stream, the Kern River, and a number of canals would be crossed by the North Bakersfield Variation within the San Joaquin Valley region. The most significant aquatic habitat that would be crossed is the California Aqueduct, which supports a relatively diverse fishery of both game and nongame species Predominant game species include channel catfish, striped bass and white catfish [BLM, 1984]. Several small ephemeral washes and intermittent streams would also be crossed, but none contain significant fisheries resources. No species of special concern occur within aquatic habitats that would be crossed by the variation.

3.3.6.7 Terrestrial Biology

3.3.6.7.1 Vegetation

General Vegetation. This alternative route would traverse agricultural land, digger pine-oak woodland, valley and foothill grassland, and Great Valley mixed riparian forest within the Techachapi Mountains (MP 0-21) and San Joaquin Valley (MP 21-111) regions. These types are described in Appendix B. Table 3.3-31 presents the distribution of these types along the route.

Table 3.3-30

MAJOR DRAINAGE CHANNELS, NORTH BAKERSFIELD VARIATION

			Sensitivity[2]		
Drainage Basin	Drainage Channel	Class[1] Flow	Channel Bed	Side Slope	MP
Buena Vista Lake	Unnamed	I	-	-	3.9
	Unnamed	I	-	-	7.9
	Unnamed	I	-	-	8.8
	Unnamed	I	-	-	9.1
	Unnamed	I	-	-	13.4
	Tweedy Creek	I	-	-	15.4
	Deer Canyon	I	-	-	18.9
	Caliente Creek	I	-	-	24.5
	Caliente Creek	I	-	-	24.6
	Rodeo Canyon	I	-	-	24.7
	Caliente Creek	I	-	-	25.2
	Walker Basin Creek	I	-	-	29.0
	Unnamed	I	-	-	30.7
	Unnamed	I	-	-	30.8
	Unnamed	I	-	-	35.2
	Unnamed	I	-	-	36.2
	Unnamed	I	-	-	38.0
	Kern River	P	L	L	45.0
	Reed Canyon	I	-	-	47.3
	Unnamed	I	-	-	50.1
	Unnamed	I	-	-	55.5
	Ledro Canal	-	-	-	57.2
	Front-Kern Canal	-	-	-	58.3
	Calloway Canal	-	-	-	59.1
	East Side Canal	-	-	-	77.8
	Depot Drain	-	-	-	78.8
	Unnamed Drain	-	-	-	79.6
	Arizona Ditch	-	-	-	79.7
	Unnamed Ditch	-	-	-	80.4
	Mirasol Ditch	-	-	-	80.8
	Florida Drain	-	-	-	81.1
	Elk Grove Drain	-	-	-	82.2
	West Side Canal	-	-	-	82.5
	Kern River Flood Canal	-	-	-	83.1
	California Aqueduct	-	-	-	84.0
	Unnamed	-	-	-	87.7

---

[1] I = intermittent, P = perennial, - = ditch or canal, artificial flow

[2] Sensitivity
Channel Bed Gradient:
L = low 0-1% M = moderate 1-3% H = high > 3%
Sideslope (topographic slope):
L = low 0-5% M = moderate 5-20% H = high > 20%

Table 3.3-31

VEGETATION COMMUNITY TYPES, NORTH BAKERSFIELD VARIATION

Geographic Region	Community Type	Milepost
Tehachapi Mountains	Agricultural Land	0-4
	Digger Pine-Oak Woodland	4-21
San Joaquin Valley	Valley and Foothill Grassland[a]	21-45
	Great Valley Mixed Riparian Forest	45-46
	Valley and Foothill Grassland (includes agricultural land)	46-111

Plant Species of Special Concern. Fifteen plant species of special concern occur in areas and habitat that would be crossed by this section of the pipeline. Fourteen of these species are federal candidates and fourteen are of special concern to the CNPS. Included in these species are four State of California protected species including California jewel flower (endangered), striped adobe lily (threatened), Tulare pseudobahia (endangered), and Bakersfield saltbush (endangered).

3.3.6.7.2 Wildlife

General Wildlife. The North Bakersfield Variation would traverse digger pine-oak woodland, agricultural land, and valley and foothill grassland. Common wildlife utilizing habitat provided by these community types has been previously described.

Wildlife Species of Special Concern. The North Bakersfield Variation would traverse the range of the federally listed and California state endangered California condor. The two, perhaps three, California condors remaining in the wild as of September 1986 use habitat crossed by the proposed route through the lower foothills of the Tehachapi Mountains. This range is considered essential condor habitat [BLM, 1984b]. Large dead conifers are used for roosting and perching, and open grassland areas with the potential for large dead animals such as cattle and sheep provide foraging opportunities within areas that ensure easy takeoff and approaches. No known roosting sites have been identified along the proposed route.

The kit fox, a federally listed endangered and California state threatened species, may be present in areas of natural grassland/ shrubland vegetation where the slope gradient is minimal [BLM, 1984b]. On the eastern side of the San Joaquin Valley, approximately 12 miles of suitable habitat occurs along this proposed variation between the eastern foothills and the Kern River. Ground investigations in this area indicated minimal presence of kit fox. This proposed route traverses approximately 23 miles of suitable habitat on the west side of the San Joaquin Valley. Ground surveys along this segment identified one active natal den and 12 active diurnal dens. Kit fox were seen nightly on spotlighting routes along this western segment.

The blunt-nosed leopard lizard, a federally and California State endangered species, may occur along this alignment. This species prefers ecotonal areas of grasses interspersed with shrubby vegetation, and occurs on flat terrain and low foothills with soils suitable for rodent burrowing [BLM, 1984b]. They do not occur in croplands. Approximately 35 miles of this proposed line traverses such suitable habitat: 12 miles on the eastern side of the San Joaquin Valley southeast of the Kern River, and 23 miles on the western side of the valley. Ground surveys conducted during June and July of 1986 identified one population of three individuals along the proposed variation within suitable habitat on the east side of the valley, and four populations with a total of nine individuals along the proposed route on the west side of the valley.

The giant kangaroo rat, a federally proposed and California state listed endangered species, prefers relatively flat grassy terrain with fine sandy soils. The giant kangaroo rat is intolerant of agricultural activities and disappears rapidly following cultivation [Williams, 1980]. This species occurs throughout the western side of the San Joaquin Valley on the relatively flat valley floors [Williams, 1980]. The latter 23 miles of this variation would cross giant kangaroo rat range. Ground surveys during June and July of 1986 identified 58 active colonies in the vicinity of the proposed pipeline between the California Aqueduct and and the terminus of the line east of Taft. The proposed alignment would cross approximately 19 miles of suitable giant kangaroo habitat.

The short-nosed kangaroo rat, a federal candidate species, prefers upland saltbush communities in the foothills and higher valleys on the south and west margins of the Tulare Basin [Williams, 1985]. They range from the western foothills east to the California Aqueduct [Williams, 1985]. As such the final 23 miles of this proposed route traverses potential habitat. Ground surveys during June-July, 1986 did not identify any active burrow systems along this proposed variation.

The Tipton kangaroo rat occurs on alluvial fan and floodplain soils ranging from fine sands to clay-sized particles, and are often associated with alkali sinks where their burrows are commonly located in slightly elevated mounds. Suitable habitat for the Tipton kangaroo rat is limited along this alignment. Approximately six miles of this proposed variation would traverse habitat identified by Williams [1985] as potentially supporting Tipton kangaroo rats. One locale is a the immediate vicinity of the California Aqueduct; the other area is a 5.7 mile segment of the ROW that parallels the railroad ROW, adjacent to Highway 58, west of Buttonwillow.

The Nelson's antelope squirrel is a federal candidate for listing and a California state threatened species. This species is associated with moderate stands of Atriplex polycarpa on the west side of the San Joaquin Valley. Burrows are frequently dug in banks of arroyos, road cuts, and along pipelines and drilling platforms [Williams, 1980]. The proposed route would traverse approximately 23 miles of Nelson's antelope squirrel range from the California Aqueduct north to its terminus east of Taft. Ground surveys during June and July of 1986 recorded 20 squirrels along this segment of the proposed route.

The Tehachapi slender salamander, a California state threatened species, may exist along north-facing slopes within moist canyons and ravines in oak-pine woodlands, and are frequently found under rotting logs and accumulated leaf litter [SCRA et al., 1980]. The proposed variation traverses less than one mile of suitable habitat for this species.

Ferruginous hawk, Swainson's hawk, tricolored blackbird, and San Joaquin pocket mouse potentially occur along this alignment. Swainson's and ferruginous hawks occur only as migrants or winter visitors. The tricolored blackbird nests in cattails and tules, and feeds in open fields. The San Joaquin pocket mouse occurs in weedy or grassy areas with fine soils.

3.3.6.7.3 Grazing

Three livestock grazing allotments would be intersected by the North Bakersfield Variation. These BLM allotments, connected to the Elk Hills Naval Petroleum Reserve, range in size from 215 to 2,278 acres. The allotments include both permanent and ephemeral ranges with sheep as the primary livestock.

3.3.6.8 Socioeconomics

3.3.6.8.1 Traffic

Since the North Bakersfield Variation would be in a more heavily populated area, the number of crossings increases, especially in the county/local category. The California Aqueduct is crossed as are at least five named canals northwest of Bakersfield. Table 3.3-32 shows these major crossings.

Table 3.3-32

TRANSPORTATION CORRIDOR CROSSINGS, NORTH BAKERSFIELD VARIATION

County and State	U.S. Inter-state	State	County and Local	Rail-roads [1]	Canals and Aqueducts
Kern, CA	I-40	CA 58(2), 184, 178, 65, 99, 43, 33	many	SP(3), AT&SF (2)	Friant Kern Canal, Calloway Canal, East Side Canal, Deep Well Ditch, Arizona Ditch, Mirasol Ditch, Eightyfoot Ditch, West Side Canal, Kern River Flood Canal, California Aqueduct

---

[1] SP = Southern Pacific, AT&SF = Atchison, Topeka and Santa Fe
( ) indicates number of crossings

3.3.6.8.2 Noise

The North Bakersfield Variation would replace segments of the primary route through the Tehachapi Mountains and the San Joaquin Valley. Projected ambient noise levels in the variation would be similar to the portions of the primary route it would replace. The variation therefore would have projected ambient noise levels ranging from 35 dBA on the eastern end to over 65 dBA through the oil fields north of Bakersfield. This noise level would be caused by the industrialized urban environment and the road and rail traffic in the region. No compressor stations would be located on the variation, and therefore pipeline construction related noise would represent a temporary situation.

3.3.6.8.3 Recreational Resources

The route of this variation passes within .5 mile of the Kern River County Park near MP 45. The park has a variety of recreational facilities including a golf course, soccer field, lakes, a zoo for native animals, campgrounds, and picnic areas [Coyle, 1986]. No other designated recreational resources are within the corridor.

3.3.6.9 Land Ownership/Use

The North Bakersfield Variation would leave the mainline at MP 722, and would continue to MP 30 on the Taft Lateral. Refer to Section 3.1.9. Within the first 18 miles of the North

Bakersfield Variation's proposed route is 5.2 miles of SCS-designated prime farmland. This variation would pass through approximately 5.6 miles of land zoned residential within the city limits of Bakersfield (see Section 3.1.9). The primary land use for the last 66 miles of the route is grazing with oil fields. Tables 3.3-33 and 3.3-34 depict land ownership and land use by county. Refer to Table 3.1-24 for rules, regulations, and policies of the administrative agencies.

Table 3.3-33
LAND OWNERSHIP, NORTH BAKERSFIELD VARIATION

	Miles and Percent for Kern County, CA
Private	104.0 (94)
BLM	4.0 (4)
Other (DOD)	3.0 (3)
Total	111.0

Table 3.3-34
LAND USE, NORTH BAKERSFIELD VARIATION

	Miles and Percent for Kern County, CA
Grazing/ Rangeland	85.0 (77)
Irrigated/ Non-Irrigated Agricultural	17.0 (15)
Residential	6.0 (5)
Elk Hills NPR	3.0 (3)
Total	111.0

3.3.6.10 Cultural Resources

3.3.6.10.1 Archaeology

The cultural resources situated within the mile-wide analysis corridor for this variation were studied in the same way as was done for the Kern River proposal discussed in Section 3.1.10.

The North Bakersfield Variation is about 111 miles long. Only ten surveys have been conducted within or partially within the analysis corridor. These surveys have covered about 8.95 miles (8.1 percent) of the proposed pipeline construction ROW. Additional surveys have covered 1.2 miles adjacent to (or perhaps partially covering) the proposed construction ROW.

There are 17 known cultural resource sites within the analysis corridor, including 16 prehistoric and one historic site. The prehistoric sites consist of five bedrock mortar sites, five mound sites, four lithic scatters, a hearth, and a stone circle. The historic site consists of habitation structural remains.

No sites are listed on or are eligible for the National Register. However, a portion of Highway 58 near the town of Tehachapi is listed in the California Inventory of Historic Resources. It may lie within the analysis corridor.

3.3.6.10.2 American Indian Concerns

No specific American Indian concerns have been identified for this variation.

3.3.6.11 Paleontological Resources

Table 3.3-35 provides information on the paleontological formations that would be traversed by the variation.

Table 3.3-35
PALEONTOLOGICAL FORMATIONS, NORTH BAKERSFIELD VARIATION

Age	Formation	Potential [1] Vertebrate/ Invertebrate	Sensitivity
Quaternary	Quaternary alluvium	L/L	No
Pleistocene	Pleistocene nonmarine	L/L	No
Precambrian/ Holocene	Igneous/metamorphic Rock	L/L	No
Pliocene/ Pleistocene	Tehachapi Formation	L/L	No
Tertiary	Walker Formation	L/L	No
Miocene	Bena gravels	L/L	No
Upper Miocene	Santa Margarita Formation	H/H	Yes
Uppermost Miocene	Kern River Formation	H/L	Yes
Holocene	Holocene basin deposits	L/L	No
Holocene	Holocene alluvial fan	L/L	No
Pliocene/Lower Pleistocene	Tulare Formation	H/L	Yes

---

[1] L = Low, M = Moderate, H = High

3.3.6.12 Visual Resources

No areas of potential scenic and visual significance have been identified for this alternative.

3.4.1 East Las Vegas/Intrastate System Alternative

The East Las Vegas Alternative incorporates the baseline information from the proposed Kern River mainline between MP 0 and 491 and the Kern River and Taft Laterals (see Section 3.1). The discussion below describes the existing environment of the pipeline between MP 491 of the Kern River route and the interconnection with the existing SoCal and PG&E intrastate transmission facilities located south of Camino, California. At this point, westward to the location of the proposed Kern River bifurcation point, no facilities would be needed since existing gas transmission lines would carry the gas to the Bakersfield area. However, to ensure that adequate capacity would be available, the FERC staff has included the construction of a new 17,000 hp centrifugal compressor station of PG&E's system at Danby, California. The reader is referred to Section 3.3.1 of Volume I for baseline information on the compressor station at Danby, California.

3.4.1.1 Air Quality

Refer to Section 3.1.1 of this volume and Section 3.3.1 of Volume I for information on baseline air quality data.

3.4.1.2 Geology

The East Las Vegas Alternative would lie predominantly in the Basin and Range province and also in the Mojave Desert. The topography is characterized by semilinear north to southwest-trending mountains and broad valleys flanked by alluvial fans. The proposed route would stay within the valleys for the most part. No faults with evidence of Quaternary movement would be crossed by the route [Nevada Bureau of Mines, 1964]. No slope instabilities exist since the route lies within alluvial fans and valleys of gentle slopes. Ground subsidence has occurred near the start of the proposed route in the Las Vegas Valley due to groundwater overdrafting [Bell, 1964]. No unique geologic features exist along the proposed route [Bell, 1964]. Gold, silver, lead, and zinc deposits are found along the mountains bordering the El Dorado and Piute Valleys [Nevada Bureau of Mines, 1964]. Table 3.4-1 summarizes geologic and physiographic conditions along the East Las Vegas Alternative.

Table 3.4-1

GEOLOGIC AND PHYSIOGRAPHIC CONDITIONS, EAST LAS VEGAS ALTERNATIVE

Location	Geol/Phys Province	Geologic Unit	Age	Topography	Comments
Las Vegas Valley (0-12)	Basin and Range	Alluvial fans and sedimentary rock, some tuffaceous	Quaternary Tertiary	Low to moderate relief,gentle to moderate slopes and flats	Unconsolidated deposits, poorly consolidated tuffs
Railroad Pass (MP 12)	Basin and Range	Diorite to granite	Tertiary	Low to moderate relief	Igneous bedrock, exposed & weathered
El Dorado Valley (MP 12-48)	Basin and Range	Alluvial fans and alluvial flat deposits	Quaternary	Low relief, gentle to moderate slopes	Unconsolidated alluvial deposits
Searchlight (MP 48)	Basin and Range	Andesites, diorites and granites	Tertiary	Moderate relief, moderate to steep slopes	Old Searchlight mining district: gold, silver, lead & copper
Piute Valley and Ward Valley (MP 48-104.5)	Basin and Range	Alluvial fans and flats	Quaternary	Low relief, gentle to moderate slopes	Unconsolidated alluvial deposits

3.4.1.3 Soil

The East Las Vegas Variation (MP 0-105) would lie within the Mojave Desert region of Nevada and would predominantly traverse deep soils and some shallow soils with hardpans on alluvial fans and terraces. Topography is mostly level to sloping. Soil susceptibility to water erosion is mostly low, and only ranges to high on a few steep slopes. Wind erosion potential is mostly low and moderate, but ranges to high on areas with sandy soils. Reclamation potential is mostly poor. Soil depth, rock fragments, sandy texture, and salinity/alkalinity are the primary limiting factors [SCS, 1977b, 1985a]. See Appendix A for a detailed description of the soil mapping units along the route of this variation and the milepost at which they would occur.

3.4.1.4 Surface Water

This alternative would lie within the Basin and Range and Mojave Desert provinces. The area is drained by numerous ephemeral tributaries to the Colorado River. The only major intermittent to perennial drainage channel that would be crossed is the Las Vegas Wash at MP 3.5. The characteristics of surface water resources that occur along the variation route were previously described for the Mojave Desert in Section 3.1.4.4.

3.4.1.5 Groundwater

General groundwater conditions along the route of the alternative are similar to those described for the alluvial valley region of the proposed mainline. Specific conditions are listed in Table 3.1-8 between MP 410-530.

3.4.1.6 Freshwater Biology

The East Las Vegas Variation would lie entirely within the Mojave Desert region. No major perennial drainages would be crossed by this variation. A number of small intermittent washes and streams would be traversed, including Duck Creek, which feeds Las Vegas Wash. No species of special concern are known to occur in the area.

3.4.1.7 Terrestrial Biology

3.4.1.7.1 Vegetation

General Vegetation. This variation would traverse Mojavean creosote bush scrub, wetland/riparian, desert saltbush scrub, and Joshua tree woodland along its route in the Mojave Desert. These types are described in Appendix B. The distribution of these types along the route is presented in Table 3.4-2.

Table 3.4-2

VEGETATION COMMUNITY TYPES, EAST LAS VEGAS VARIATION

Geographic Region	Community Type	Milepost
Mojave Desert	Mojavean Creosote Bush Scrub	0-5
	Wetland/riparian	5-5.5
	Desert Saltbush Scrub	5.5-20
	Mojavean Creosote Bush Scrub	20-46
	Joshua Tree Woodland	46-51
	Mojavean Creosote Bush Scrub	51-104.5

Plant Species of Special Concern. Two federal candidate species may occur in areas traversed by this variation. Appendix C describes these species and their habitat.

3.4.1.7.2 Wildlife

General Wildlife. The habitat types traversed by this alignment are creosote bush scrub, saltbush scrub and Joshua tree woodland. Wildlife species commonly associated with these communities have been previously described. Gambel's quail occur throughout desert scrub communities, and as such potentially occur within most of the analysis corridor. No crucial habitat has been delineated along the proposed route [BLM, unpublished data g].

Potential raptor nesting habitat is available throughout the area where high relief features occur. No nests have been identified within the area of concern, although a complete inventory of the area has not been conducted [BLM, unpublished data g].

Wildlife Species of Special Concern. The bald eagle and peregrine falcon are the only federally listed species that may occur in the area. They occur only as rare migrants.

The desert tortoise is a federal candidate, California BLM sensitive species, a Nevada state rare species, and is fully protected by the State of California under Sections 5000-5002 of the California Fish and Game Code 1983. Tortoise populations and habitat sites have been identified through documentation from the BLM [1982] for Nevada, and Berry [1984] for California. Because the tortoise and its habitat is sensitive to harassment, exact locations of these sites are not delineated in this document. Tortoise habitat occurs throughout the vicinity of this alignment, and the proposed route crosses one Nevada crucial habitat site in Piute Valley for 16 miles. In California the proposed alignment traverses five miles of high tortoise density (100-250/mi^2); 14 miles of moderately high density (50-100/mi^2) and 12 miles of moderate density (20-50/mi^2).

Desert bighorn range occurs in the River, El Dorado, and Highland mountains [BLM, 1982]. The proposed route generally circumvents these ranges and the analysis corridor minimally encroaches on bighorn range only in the vicinity of the River and El Dorado Ranges [BLM, 1982].

The western snowy plover is a federal candidate potentially nesting on alkali flats within the creosote scrub community. No nesting sites have been identified within the analysis corridor.

3.4.1.7.3 Grazing

The Kern River East Las Vegas Alternative would intersect four BLM livestock grazing allotments. These allotments vary in size from 10,371 to 344,607 acres. Cattle are found on these mostly ephemeral ranges. See Appendix D for details.

3.4.1.8 Socioeconomics

3.4.1.8.1 Traffic

The crossings for the proposed construction are shown in Table 3.4-3.

Table 3.4-3

TRANSPORTATION CORRIDOR CROSSINGS, EAST LAS VEGAS ALTERNATIVE

County, State	U.S. Interstate	U.S. Federal	State	County & Local	RR 1/	Canals
Clark, NV	-	US 93/ 95(2)	NV 147,165 165, 164, 163	30+	UP	1
San Bern. CA	I-40	-	-	5	AT&SF	-

1/ UP = Union Pacific AT&SF = Atchison, Topeka and Santa Fe

3.4.1.8.2 Noise

Projected ambient noise levels along in this alternative would remain essentially similar to those of the Kern River route in Nevada. Projected ambient noise levels would range from 35 to + 80 dBA. The majority of the route south of Henderson, Nevada, would run through essentially undeveloped rural areas which would have ambient noise levels in the 35 to 40 dBA range. No sensitive noise receptors are located within three miles of the proposed compressor station at Danby.

3.4.1.8.3 Recreational Resources

In Clark County the alternative would cross portions of the Rainbow Gardens and the proposed Clark County Wetlands Park. Typical recreational activities would include nature study, hiking, and sightseeing in both areas. Rainbow Gardens is in an area important for its geologic exposures encompassing millions of years of the earth's history. The principal concerns of the Las Vegas Wetlands Park Commission pertain to soil and vegetation disturbances, but construction activities could potentially interfere on a short-term basis with the public enjoyment of the area.

The remainder of the line throughout Clark and San Bernardino County lies within principally arid lands lacking specific recreational resources.

3.4.1.9 Land Ownership/Use

The East Las Vegas Alternative would begin at MP 491 on the mainline in Rainbow Gardens. At approximately MP 4 it would enter the Henderson city limits and remain for the next 10 miles. It passes through an area zoned for residential uses and limited service area. It then traverses an area west of Boulder City. Between MP 47-51 it is proposed to pass through an area of private mining. At approximately MP 81 the pipeline would enter San Bernardino County, California, until it crosses Interstate 40 at approximately MP 95. The route lies within Corridor E of the CDCA. The proposed alternative would terminate at about MP 9 of Mojave's mainline where it would use the existing facilities to complete the route to Bakersfield. The intrastate companies would then need to construct laterals similar to the Kern River Lateral (3.1.9.2) and Taft Lateral (3.1.9.3).

Tables 3.4-4 and 3.4-5 depict land ownership and land use by county. Refer to Table 3.1-24 for rules, regulations, and policies of the administrative agencies.

The Danby Compressor Station is located on private land. The land use is grazing.

Table 3.4-4

LAND OWNERSHIP, EAST LAS VEGAS ALTERNATIVE

	Miles and Percent		
	Clark, NV	San Bernardino, CA	TOTAL
Private	4.4 (6)	4.4 (18)	8.8 [8]
BLM	75.2 (94)	20.7 (82)	95.7 [92]
TOTAL	79.6	25.1	104.5

Table 3.4-5

LAND USE, EAST LAS VEGAS ALTERNATIVE

	Miles and Percent		
	Clark, NV	San Bernardino, CA	TOTAL
Grazing/ Rangeland	67.1 (87)	27.4 (100)	94.5 [90]
Residential	10.0 (13)	-	10.0 [10]
TOTAL	77.1	27.4	104.5

3.4.1.10 Cultural Resources

3.4.1.10.1 Archaeology

The inventory of cultural resources situated within the mile-wide corridor of the East Las Vegas Variation was somewhat more difficult than for the other variations. This was because the precise routing was not available. It was necessary to transfer the pipeline route as drawn on 1:250,000 maps to 7.5' and 15' maps. While great care was taken in this process, the routing must be viewed as approximate and the cultural inventory treated accordingly, especially when the number of direct and indirect site impacts are concerned.

Nevada. The Nevada portion of this alternative is about 65 miles in length. At least 39 surveys have been conducted within or partially within the mile-wide analysis corridor. These surveys have covered approximately 3.5 miles (5.3 percent) of the proposed pipeline construction ROW.

There are 24 known cultural resource sites that appear to be situated within the analysis corridor, including 18 prehistoric and six historic sites. Prehistoric sites include eight lithic scatters, three rockshelters (one associated with a quarry), two additional quarry sites, four isolated finds and a site of unknown type. Historic sites include a mining camp, a mine with associated historic dump, a mining site, a squatter's camp (mistakenly called the Alunite townsite), and a cemetery. The route also passes close to the Alunite historical townsite and nearby mine.

In the Henderson area the route crosses the Las Vegas Wash which is a highly sensitive area for prehistoric sites, but it misses a cluster of known sites which lie outside the analysis corridor.

There are no sites which are listed on or are eligible for the National Register within the proposed analysis corridor.

California. This segment is about 40 miles long. At least two surveys have been conducted within or partially within the proposed mile-wide analysis corridor. None of these surveys covered portions of the proposed pipeline construction ROW.

There are 13 known cultural resource sites that appear to be situated within the mile-wide analysis corridor, including 11 prehistoric and two historic sites. Prehistoric sites include seven lithic scatters, a campsite with lithics, a rock cairn, a stone circle with lithics, and a possible stone circle. Historic sites include portions of the Old Mojave Road and the National Old Trails Highway. The latter is listed as a California Historic Landmark (CHL #781). Ten of the prehistoric sites are located within the same square mile section which suggests a potential for moderate to high site densities within a few miles of the Nevada border.

Summary. The East Las Vegas Alternative is 104.5 miles long. At least 41 surveys have been conducted within or partially within the mile-wide analysis corridor. Approximately 3.5 miles (3.3 percent) of the proposed pipeline construction ROW has been previously surveyed. A total of 37 known cultural resource sites are located within the analysis corridor, including 29 prehistoric and eight historic sites. One historic site is listed as a California Historical Landmark (CHL #781).

3.4.1.10.2 American Indian Concerns

The East Las Vegas Variation does not cross any reservation lands, but it does cross several traditional ethnographic use areas that are sensitive to American Indians. These include the Frenchman Mountains north of Henderson and the Eldorado Valley (and dry lake) and Black Hills located south of Henderson which are sensitive for the Pahrump and Las Vegas Paiute [Stoffle and

Dobyns 1982; 168]. They also include the Las Vegas Wash which is a sensitive area for most Southern Paiute, and the Piute Wash in California which is a sensitive area for the Fort Mojave Indians and which contains numerous archaeological sites. A portion of the Rainbow Gardens, which are sensitive to most Southern Paiute, lies within the analysis corridor. Finally, Evans [1981:16] notes the importance of the Chemehuevi trade trail that begins about ten miles north of Needles and extends to the Providence Mountains. The East Las Vegas Variation would thus cross this trail which is considered sensitive by both the Chemehuevi and Mojave Indians groups. It is not known whether this trail has any integrity within the analysis corridor.

3.4.1.11 Paleontological Resources

Table 3.4-6 provides information in paleontological formations which would be traversed by the alternative.

Table 3.4-6

PALEONTOLOGICAL FORMATIONS, EAST LAS VEGAS ALTERNATIVE

Age	Formation	Potential 1/ Vertebrate/ Invertebrate	Sensitivity
Triassic	Moenkopi/Chinle Formation	H/H	Yes
Miocene	Horse Spring Formation; Thumb Member	L/L	No
Miocene	Miocene volcanics	I.D	I.D.
Quaternary	Quaternary alluvium	H/H	Yes
Precambrian	Precambrian undifferentiated	L/L	No
Pleistocene	Pleistocene non-marine sedimentary	M/M	No
Quaternary	Quarternary lake deposits	H/M	Yes
Tertiary	Tertiary non-marine sedimentary	H/L	Yes
Quaternary	Igneous/metamorphic undifferentiated	L/L	No

1/ L = Low, M = Moderate, H = High

3.4.1.12 Visual Resources

MP 0-4, VRM/VQO: BLM Class II and IV
Description: Las Vegas Wash/Rainbow Gardens Wetlands. The landform consists of wetlands and flat, intermittent washes adjacent to small hills. Irregular erosion patterns have revealed vivid soil colors with textured variety, making the area geologically unique. The vegetation consists of creosote bush scrub, mesquite and sagebrush scrub, and riparian plant communities in wetland areas. Modifications include secondary roads, mines, the Las Vegas lateral beneath the Las Vegas Wash, and development on the outskirts of the city of Henderson.

3.4.2 East Las Vegas Alternative with the Wasatch Variation

In this scenario the baseline information for the proposed Kern River mainline between MP 0-74 and MP 204-491 and the Kern River and Taft Laterals would be examined (see Section 3.1). In addition, the Wasatch Variation which replaces sections of the mainline between MP 74 and 204 and the East Las Vegas alternative would be examined (see Sections 3.3.1 and 3.4.1).

3.4.3 Northwest/PGT/Integrated System Alternative

Affected environment for this scenario would be similar to those discussed for the El Paso 600 MMcfd case (see Section 3.6.1 of Volume I) and the Transwestern (see Section 3.7 of Volume I). Existing facilities would be employed for the remainder of the route across southern California, as well as Washington, Idaho, Oregon, and northern California.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

Chapter 4 presents a discussion of the environmental consequences that would result from implementing the Kern River Pipeline Proposal and the respective variations. In keeping with NEPA and CEQA guidelines, this chapter focuses on the impacts that are considered significant. The general approach followed throughout this chapter is to briefly discuss the range of impacts that would occur and then provide a detailed discussion of those impacts that are considered significant.

Following the discussion of impacts, Chapter 4 provides planned mitigation measures put forth by the applicant. These mitigation measures are evaluated and determinations on significance have been revised. If the significance rating has not been reduced to acceptable levels, a second set of mitigation measures, if appropriate, were developed by the EIS study team. The impacts were then reassessed and determinations on unavoidable adverse impacts were made.

4.2 KERN RIVER PROPOSAL

4.2.1 Air Quality

As stated in Section 3.1, pollution emissions that occur during construction are generally exempt from PSD review because the PSD requirements specifically exempt temporary increases of SO_2 and TSP emissions.

None of the states have construction-related emission standards. New Source Review (NSR) regulations of California Air Resources Board (CARB) and the respective Air Pollution Control Districts (APCD) of Kern and San Bernardino Counties do not address whether or not emissions from construction activities are regulated. Presently, construction activities are not regulated by the two local APCDs. As such, there are no emission impact standards with which the emissions from these construction activities can be compared to determine whether a regulation "violation" will occur. Nevertheless, CARB notes that although an air quality permit may not be required, county land use permits require analysis of a project's air quality impacts under CEQA and air quality modeling is often used. Because CARB seeks this type of modeling, this has been done for the State of California only. The other states do not require modeling for construction and therefore modeling was not done.

The predictions, for comparison purposes, are measured against the National Ambient Air Quality Standards (NAAQS).

This results in a predicament. While the model shows ambient standards could be exceeded immediately adjacent to the ROW during adverse meteorological conditions, construction emissions are not regulated. The application of mitigation is thus not enforceable under current regulatory authority. This leads the preparers to seek assistance from interested parties and the agencies responsible for regulating air quality impacts to address the issues raised above.

4.2.1.1 Project Emissions

4.2.1.1.1 Installation/Construction Emissions

The installation/construction phase of the proposed project would include installation of approximately 300 miles of pipeline within California (mainline and laterals). Emissions associated with these activities would include fugitive dust and construction equipment exhaust emissions. Exhaust emission would include carbon monoxide (CO), sulfur oxides (SO_2), nitrogen oxides (NO_x), hydrocarbons (HC), total suspended particulates (TSP), and fine (inhaleable) particulates (PM10). An impact analysis was performed for construction activities occurring in California only for reasons discussed in Volume I, Section 4.2.1.2.

Due to a lack of specific information concerning equipment types and usage rates, emissions for the pipeline were assumed to be emitted at the same amount per mile as the Mojave 36-inch diameter pipeline. Total estimated construction emissions for that portion of the construction activity occurring in California are presented in Table 4.2-1.

Table 4.2-1

TOTAL ESTIMATED CONSTRUCTION EMISSIONS WITHIN CALIFORNA,
KERN RIVER PROPOSAL [1]

	Total Project Emissions (tons)					
	THC	NO_x	SO_2	CO	TSP	PM10
Mainline	40.29	212.73	19.74	115.47	598.20	387.96

4.2.1.1.2 Operational Phase Emissions

Operational phase emissions would result from natural gas combustion at each of the three compressor stations. Since compressor equipment specifications have not yet been developed, best engineering judgement was used to estimate specific equipment sizes at each compressor station. The compressors were assumed to operate continuously at an average capacity of 81 percent, while the worst-hour emissions were at 85 percent capacity. Additional combustion emissions would result from occasional testing of an emergency generator.

NO_x, HC, and CO emission estimates were based on AP-42 [EPA, 1985] emission factors. Worst-hour and annual emission estimates from each compressor station are summarized in Table 4.2-2. SO_2 and particulate emissions would be negligible. Fugitive hydrocarbon emissions from valves, flanges, etc. during the operational phase would also be negligible. Whatever small emissions do occur would be primarily photochemically nonreactive. Additional information concerning production phase emissions can be found in the Air Quality/Meteorology Technical Report.

Table 4.2-2

WORST-HOUR AND ANNUAL AIR QUALITY EMISSION ESTIMATES,
KERN RIVER PROPOSAL COMPRESSOR STATIONS

	Total Project Emissions (tons)					
	THC	NO_x	SO_2	CO	TSP	PM10
Compressor Station No. 1						
Worst-hour (lb/hr)	6.22	50.56	0.06	17.14	0.00	0.00
Annual (tons/hr)	12.29	177.18	0.24	67.15	0.00	0.00
Compressor Station No. 3						
Worst-hour (lb/hr)	4.85	30.59	0.03	9.56	0.00	0.00
Annual (tons/hr)	6.54	93.84	0.13	35.54	0.00	0.00
Compressor Station No. 5						
Worst-hour (lb/hr)	4.98	32.56	0.04	10.31	0.00	0.00
Annual (tons/hr)	7.11	102.07	0.14	38.66	0.00	0.00

4.2.1.2 Installation/Construction Impacts

This section discusses the air quality impacts resulting from project-related emissions of inert pollutants (NO_2, CO, SO_2, TSP, and PM10). Impacts of both the construction and operation for the project were anlayzed using EPA-approved dispersion models. Modeling methodologies, and a more detailed discussion of the impacts are presented in the Air Quality/Meteorology Technical Report.

The following sections discuss the results of short-term construction, and short-term and annual operational modeling. The pipeline routes have been divided into sections by state and areas of background concentration. In many cases background TSP values already exceed state and federal standards.

The short-term Industrial Source Complex (ISC) modeling results for pipeline construction within California are presented in Tables 4.2-3 and 4.2-4 along with local background concentrations and applicable state and federal standards.

The results indicate that pipeline construction would exacerbate the existing 8-hour CO standard exceedance in Kern County. The project contribution would be fairly small in comparison to the existing background. The California 1-hour NO_2 standard of 470 ug/m^3 and the 24-hour SO_2 standard of 131 ug/m^3 would be exceeded in both Kern County and in the Southeast Desert Air Basin. The federal primary standard (260 ug/m^3) and secondary standard (150 ug/m^3) for 24-hour TSP would also be exceeded in both areas. The California standard of 50 ug/m^3 for 24-hour PN10 (which already is exceeded by high background values) would also be exceeded.

4.2.1.3 Operational Phase Impacts

Short- and long-term impacts from operations at the proposed three Kern River compressor stations are presented in Tables 4.2-5, 4.2-6, and 4.2-7. No ambient air quality standards are predicted to be violated.

4.2.1.4 Visibility Impact Analysis

A Level-1 Visibility Impact Analysis recommended by the EPA was performed to assess the operation impacts of the compressor stations. The results of the Level-1 Visibility Impact Screening Analysis indicated that none of the proposed compressor stations would cause any significant visibility impacts at the PSD Class I areas. A more detailed discussion of the screening analysis can be found in the Air Quality/Meteorology Technical Report.

4.2.2 Geology

The significant geologic hazards and potential impacts of the project on the geologic environment are the same as those listed in Section 4.2.2, Volume I. Comments made in Section 4.2.2, Volume I, regarding geologic hazards and impacts along the Mojave Mainline and Kern Lateral, also apply to the Kern River Mainline between MP 620 and 756, and the Kern River and Taft Laterals. The following discussion focuses on additional geologic hazards and impacts which the Kern River Proposal does not share with the Mojave Proposal. Actual fault crossings along the Kern River route are identified in Table 3.1-6.

Table 4.2-3

AIR QUALITY CONSTRUCTION IMPACTS THROUGH S.E. DESERT AIR BASIN, CA, KERN RIVER PROPOSAL
(all values are in ug/m3)

Pollutant	Avg. Time	California Standard	State and Federal Standards Primary	State and Federal Standards Secondary	Project Impacts: Project Increment	Project Impacts: Background	Project Impacts: Total
Carbon Monoxide (CO)	1-hr	23,000	40,000	40,000	961	12,000	12,961
	8-hr	10,000	10,000	10,000	625	4,000	4,625
Nitrogen Dioxide (NO_2)	1-hr	470	--	--	404	226	630
Sulfur Dioxide (SO_2)	1-hr	655	--	--	152	393	545
	3-hr	--	--	1,300	110	175	285
	24-hr	131	365	--	39	110	149
Total Suspended Particulates (TSP)	24-hr	--	260	150	746	144	890
Fine Suspended Particulated (PM-10)	24-hr	50	--	--	485	79	564

Background values were taken from:
CO - Barstow (CA)
NO_2 - Barstow (CA)
SO_2 - Riveria (AZ)
TSP - Barstow (CA)
PM/10 - 55% of TSP
1-hr SO_2 - Bakersfield (CA)

Table 4.2-4

AIR QUALITY CONSTRUCTION IMPACTS THROUGH KERN COUNTY, CA, KERN RIVER PROPOSAL
(all values are in ug/m3)

Pollutant	Avg. Time	California Standard	State and Federal Standards		Project Impacts		
			Primary	Secondary	Project Increment	Background	Total
Carbon Monoxide (CO)	1-hr	23,000	40,000	40,000	961	16,000	16,961
	8-hr	10,000	10,000	10,000	625	13,000	13,625
Nitrogen Dioxide (NO_2)	1-hr	470	--	--	422	301	723
Sulfur Dioxide (SO_2)	1-hr	655	--	--	152	393	545
	3-hr	--	--	1,300	110	175	285
	24-hr	131	365	--	39	131	170
Total Suspended Particulates (TSP)	24-hr	--	260	150	746	359	1,105
Fine Suspended Particulated (PM-10)	24-hr	50	--	--	485	197	682

Background values were taken from:
CO - Barstow (CA)
NO_2 - Barstow (CA)
SO_2 - Riveria (AZ)
TSP - Barstow (CA)
PM10 - 55% of TSP
3-hr SO_2 - Bakersfield (CA)

Table 4.2-5

WORST-HOUR AND ANNUAL OPERATIONS, AIR QUALITY IMPACTS, KERN RIVER COMPRESSOR STATION #1 (SW WYOMING)

(all values are in ug/m3)

				Project Impacts		
Pollutant	Wyoming Standard	Federal Primary Standard	Federal Secondary Standard	Project Increment	Background	Total
WORST-HOUR						
Carbon Monoxide (CO)						
8-hr average	10,000	10,000	10,000	8	9,000	9,008
1-hr average	40,000	40,000	40,000	11	17,000	17,011
Sulfur Dioxide (SO2)						
24-hr average	260	365	--	0	183	183
3-hr average	--	--	1,300	0	419	419
Total Suspended Particulates (TSP)						
24-hr average	150	260	150	0	353	353
ANNUAL						
Nitrogen Dioxide (NO2)	100	100	100	1	38	39
SO2	52	78	--	0	26	26
TSP	60	75	60	0	353	353

Background values were taken from:
CO - Bountiful (UT)
SO2 - Bountiful (UT)
TSP - Evanston (WY)

Table 4.2-6

WORST-HOUR AND ANNUAL OPERATIONS, AIR QUALITY IMPACTS, KERN RIVER COMPRESSOR STATION #3 (CENTRAL UT)

(all values are in ug/m3)

		State and Federal Standards		Project Impacts		
Pollutant	Avg. Time	Primary	Secondary	Project Increment	Background	Total
WORST-HOUR						
Carbon Monoxide (CO)	1-hr	40,000	40,000	11	17,000	17,011
	8-hr	10,000	10,000	8	9,000	9,008
Sulfur Dioxide (SO2)	3-hr	--	1,300	0	550	550
	24-hr	365	--	0	183	183
Total Suspended Particulates (TSP)	24-hr (Geo. Mean)	260	150	0	211	211
ANNUAL						
Nitrogen Dioxide (NO2)		100	100	2	38	40
Sulfur Dioxide (SO2)		80	--	0	26	26
Total Suspended Particulates (TSP)		75	60	0	52	52

Background values were taken from:
CO - Bountiful (UT)
NO2 - Bountiful (UT)
SO2 - N. Salt Lake (UT) (worst-hour)
TSP - Cedar City (UT)
SO2 - Bountiful (UT) (annual)

Table 4.2-7

WORST-HOUR AND ANNUAL OPERATIONS, AIR QUALITY IMPACTS, KERN RIVER COMPRESSOR STATION #5 (SOUTHERN NEVADA)

(all values are in ug/m3)

				Project Impacts		
Pollutant	Nevada Standard	Federal Primary Standard	Federal Secondary Standard	Project Increment	Background	Total
WORST-HOUR						
Carbon Monoxide (CO)						
8-hr average	10,000	10,000	10,000	8	22,000	22,008
1-hr average	40,000	40,000	40,000	11	29,000	29,011
Sulfur Dioxide (SO2)						
24-hr average	365	365	--	0	110	110
3-hr average	--	--	--	0	175	175
Total Suspended Particulates (TSP)						
24-hr average	--	--	150	0	1,019	1,019
ANNUAL						
Nitrogen Dioxide (NO2)	100	100	100	16	58	74
SO2	80	80	--	0	28	28
TSP	75	75	60	0	101	101

Background values were taken from:
CO - Las Vegas (NV)
NO2 - Las Vegas (NV)
SO2 - Riviera (AZ)
TSP - Las Vegas (NV)

4.2.2.1 Seismicity and Faulting

The Intermountain Seismic Zone (ISZ) extends from northwestern Montana to northwestern Arizona along a north-south alignment. According to Smith [1978], the most seismically active portions of the Middle Rocky Mountains and the Basin and Range region are included in the ISZ. The largest historic earthquake in the ISZ was the 1959 (M=7.1) Hebgen Lake earthquake. Several historic seismic events have had magnitudes between 6 and 6.75. Numerous Holocene and Quaternary fault scarps have been mapped in the ISZ [Anderson and Miller, 1979; Cluff et al., 1981] and are also potential loci of seismicity. Maximum Richter magnitude predicted for the ISZ is approximately 7.5. A recurrence interval of about 200-500 years is estimated along the Wasatch fault zone for an event of this magnitude.

Data developed by Cluff, et al. [1981] for the Salt Lake area indicate that offset has occurred on portions of the Wasatch fault zone within the past 450 years. Offset along the fault has varied from a few feet up to 15 feet or more. Recent mapping along the Wasatch Front [Machette et al., 1986] indicates that the Wasatch fault zone may be comprised of up to 10 discrete fault segments, each of which behaves somewhat differently. Each identified segment may be long enough to generate a magnitude 7.5 earthquake with significant surface displacement. The maximum amount of offset could exceed 10 to 20 feet in response to the maximum credible earthquake.

The Basin and Range region has historically exhibited a relatively low level of seismicity when compared to the ISZ and the San Andreas fault system.

Within the Basin and Range region, Holocene and Quaternary fault scarps are relatively abundant [Howard, et al., 1978; Nakata, et al., 1982]. Numerous minor earthquakes of less than magnitude 4.0 have occurred within historic time. The proposed route passes near, parallels or crosses a number of active or potentially active faults between MP 114 and 620. Compressor Station No. 3 is located in the vicinity of small Quaternary faults at White Sage Flat.

Secondary seismic effects triggered by strong ground shaking are often more serious than the shaking itself. Soil liquefaction can occur in loose saturated sand, silty sand and sandy silt soils when subjected to moderate to strong ground shaking. Anderson, et al. [1982, 1986] have mapped the liquefaction potential for Davis, Salt Lake, and Utah Counties along the Wasatch Front. The likelihood and effects of soil liquefaction depends on the intensity of vibratory ground motion, physical properties of the sediments such as grain size, sorting, and moisture content, and the slope of the terrain. Lateral spreading failures can occur on slopes as gentle as 0.5 percent, and flow slides on 5 percent slopes, when subject to liquefaction.

Soils probably subject to liquefaction along this portion of the proposed route occur where the route crosses the unconsolidated sediments of prehistoric Lake Bonneville in the Salt Lake, Juab, and Pavant Valleys.

Moderate to strong ground shaking can trigger renewed movement or cause enlargement of existing landslides as well as induce new failures. Landslides triggered by strong ground shaking may occur within the Middle Rocky Mountains.

4.2.2.3 Slope Stability

Slope stability concerns are significant over major portions of the line as indicated in Table 4.2-8 where the risk of landslide damage to the mainline is significant in the Middle Rocky Mountains. Areas with the greatest potential for landslides include those underlain by bentonitic shales and siltstones, poorly consolidated Tertiary deposits of silt and clay, and colluvial slopes. These include the portions of the proposed route underlain by the Green River, Wasatch, and North Horn Formations in the Middle Rocky Mountains. These formations include siltstones and claystones that typically have low shear strength. Significant slope stability problems have developed within the past three years in the Wasatch Mountains due to above-average annual precipitation. However, significant slope stability problems have been an historic situation in the Middle Rocky Mountains.

Areas underlain by shales of the Morrison, Chinle, and Moenkopi formations east and northeast of Nephi may also be subject to slope instability, particularly where these units dip steeply downslope. Numerous slides have been mapped and are evident within the Salt Creek drainage and on the west slope of the San Pitch Mountains.

Landslides can be caused by construction and operation of the pipeline on unstable slopes. Construction activities will affect soil structure and subsurface water flows, with possible adverse effects to slope stability. A change in groundwater movement, due to cuts and fills for road and pipeline construction or pipeline trenching and backfilling on steep slopes, can affect soil moisture. This change in soil moisture can potentially change soil saturation and cause slides and debris flows. It is important to note that slides occur not only from excessive precipitation, but also from seismic shaking, construction grading, and other natural or man-related causes.

If a landslide caused by construction activities is deposited in a narrow canyon or stream valley, the subsequent potential for upstream flooding, or debris flows and debris flooding downstream, by remobilization of the slide mass, could be a significant threat to public safety. Considerable damage to

Table 4.2-8

SIGNIFICANT GEOLOGICAL HAZARDS, KERN RIVER PROPOSAL

Mile-post	Location	Liquefaction/ Ground Failure	Surface Fault Rupture	Slope Instability	Ground Subsidence	Flash Flooding	Avalanche
74-85	Mainline	-	-	X	-	-	-
109-118	Mainline	-	-	X	-	-	-
126-146	Mainline	-	-	-	-	-	X
123-147	Mainline	-	-	X	-	-	-
148-153	Thistle Slide	-	-	X	-	-	-
160-170	Mainline	-	-	X	-	-	-
178-181	Mainline	-	-	X	-	-	-
184-186	Nephi Wasatch Fault	X	-	-	-	-	-
186-220	Mainline	X	-	-	-	-	-
230-719	Mainline	-	-	-	-	X	-
278-381	Mainline	-	-	X	-	-	-
310-323	Mainline	-	-	X	-	-	-
638-646	Mainline	-	X	X	-	-	-
718-722	Tehachapi Mtns.	-	-	X	-	-	-
719	Garlock Fault	-	X	-	-	-	-
750-751	Mainline	-	-	X	-	-	-
754-756	Mainline	-	-	X	X	-	-
754	White Wolf Fault	-	X	-	-	-	-
750-758	Taft Lateral	-	X	-	X	X	-
10-32	Kern Lateral	-	X	-	-	-	-

homes and roadways occurred at Thistle, Farmington, and Bountiful, Utah, in 1983 from such a sequence of events, although the initiating landslides in those cases were probably due to natural causes.

Landslides associated with permanent cut-and-fill slopes created during construction could result in structural failure of the pipeline. Instability of temporary construction slopes or trench excavations, while important to safety and constructability, would not trigger impacts related to rupture of the pipe.

4.2.2.4 Subsidence

Holocene alluvial fans and many Quaternary fans in the Basin and Range region are potentially susceptible to some degree of soil collapse if fully saturated. Such collapse could cause differential settlement which could compromise the integrity of the pipeline; however, the alluvial soils within the Basin and Range region have a very low probability of being subjected to conditions as a result of pipeline construction activities which could saturate the soils.

4.2.2.5 Flash Floods and Debris Flows

All ephemeral drainages in the Basin and Range region and Middle Rocky Mountains are susceptible to flash flooding during rare torrential rains. Some areas subject to flash flooding are also subject to debris flows. These flows occur where flash flood channels are entrenched into easily eroded materials entrained by the floods. Such areas are limited to drainages which head in unconsolidated sediments or landslide deposits.

Flash flooding or debris flows along the pipeline could create a rupture if the pipeline becomes exposed.

4.2.2.6 Volcanics

The proposed route passes near two areas of Late Quaternary or Holocene volcanic activity. These are the rhyolite and basaltic centers within the Basin and Range region between Pavant Butte and Black Rock Volcano (MP 240-275) and the Lima Dome volcanic field in the Mojave Desert (MP 560-570). Neither of these areas is currently active, nor have they been active during historic times. Minor dissection of flows and cones in both areas suggest that their latest activity was late Pleistocene or early Holocene. Consequently, volcanic hazards from activity of these centers are relatively low.

4.2.2.7 Avalanches

The higher ridges and mountain slopes of the Middle Rocky Mountains are frequently subjected to avalanches. Of the many forms of avalanches, only major slab avalanches could potentially damage the pipeline by either scouring the cover material from the pipe and subjecting the pipe to large shear forces or by piling a large volume of debris on the pipe and crushing it. In the high mountains where the route follows prominent ridgelines the risk of avalanche damage is low. However, where the pipeline route crosses major drainages at high elevations potential damage to the pipeline could be sufficient to rupture the line.

4.2.2.8 Mineral/Petroleum Resources

No significant adverse impacts to active or planned mineral or petroleum developments would be expected to result from implementation of the Kern River proposal.

4.2.3 Soil

Impacts to soils were considered significant if increased erosion rates or reductions in soil productivity resulting from project activities would prevent successful rehabilitation and eventual vegetation regeneration. Evaluations of successful rehabilitation are based on whether soils having erosion or reclamation constraints would stabilize to near-preconstruction erosion conditions and support pre-existing land uses within a few years following application of proposed plans and compliance with federal stipulations for erosion control and revegetation.

Proposed construction would alter and disturb soil within the pipeline ROW and at surface facility sites. These impacts would include loss of topsoil, including mixing of topsoil with less suitable subsoil material; removal of vegetative cover and/or disturbance of desert pavement in arid areas resulting in accelerated soil erosion; soil compaction; and reduction in soil productivity. These impacts would affect runoff, water erosion, sediment yield, wind erosion, and soil stability, as well as affect the soil as a medium for plant growth.

Impacts to soils would result primarily from an increased susceptibility to erosion or displacement. The degree of susceptibility to erosion would vary according to soil erodibility characteristics, topography, surface roughness, and the presence or absence of protective soil cover such as vegetation, plant residues, gravel, cobble, or rock. The amount of erosion would be related to the time between the disturbance and reestablishment of vegetation or implementation of erosion control measures. Soil productivity could be reduced by the loss of topsoil or the mixing of topsoil with substratum materials excavated from the trench that are less suitable or unfavorable for plant growth because of nutrient imbalances or deficiencies, salinity/alkalinity, rock fragments, sand, clay, or unweathered bedrock.

In addition to the above impacts related to increased erosion or reduced productivity, some agricultural lands will also be impacted by disruption of irrigation systems as well as surface and subsurface drainage systems.

Indirect impacts to soils would possibly include the disturbance of reclaimed and stabilized portions of the ROW due to increased access by off-road vehicles. This type of potential disturbance would take the form of vegetation loss, soil destabilization, increased erosion (rilling and gullying), and/or soil compaction.

Impacts were analyzed for three impact categories including water erosion potential, wind erosion potential, and reclamation potential. The Universal Soil Loss Equation was used to estimate water erosion on specific soil units which may include soil mapping units, soil series, or slope phases, depending on the level of detail of information on soils in a given area. These estimates were made for a freshly topsoiled and seeded condition. The range in estimated erosion was divided into classes of low, moderate, and high (see footnote at bottom of Table 4.2-9). Each soils unit was assigned an erosion potential class. The total distance that the pipeline would traverse in each erosion class was summed for each geographic region to obtain cumulative miles of soils traversed with low, moderate, and high erosion potential.

Wind erosion potential classes were based on wind erodibility groups, wind erosion potential, and/or the texture of the surface soil horizons for each soil unit presented in the published and unpublished soil surveys. Cumulative distances of soils in each wind erosion potential class were derived as presented for water erosion potential above.

Reclamation potential was assigned to each soil unit using six criteria: average annual precipitation, dominant slope gradient, depth to bedrock, salinity, soil texture, and coarse fragment content. Cumulative distances of soils in each reclamation potential class were obtained as described above.

The soil units which served as the basic unit of soil information may range in width from 0.1 to over 10 miles. These units or groups of units typically are distributed in repeating sequences. Consequently, the specific or basic data base used and the water and wind erosion potential calculations and reclamation assignments for these units would be too voluminous to be presented in this document. Thus, these units have been aggregated into soil associations and their distribution and character presented in Appendix A. General locations of areas with poor reclamation potential, high water erosion potential, or wind erosion potential can also be found in this appendix.

4.2.3.1 Kern River Mainline

The distribution of potential soils impacts is presented in Table 4.2-9. Summary descriptions of soils impacts are presented below.

4.2.3.1.1 Wyoming Basin (MP 0-40)

In the Wyoming Basin area the probability for significant water erosion is mostly low to moderate, with high potential on a lesser portion of the route. The probability for significant wind erosion is moderate. Reclamation potential is mostly fair and poor, indicating sizeable portions would have significant revegetation problems.

4.2.3.1.2 Middle Rocky Mountains (MP 40-185)

In the Middle Rocky Mountains area the probability for significant water erosion is evenly distributed within the low to high range. Low potential areas are characterized by gentle topography while high potential areas occur along steeper mountainous slopes. The potential for significant wind erosion is low to moderate. Reclamation potential is mostly fair and poor, indicating sizeable portions of the route would have significant revegetation problems.

4.2.3.1.3 Basin and Range (MP 185-390)

In the Basin and Range area the probability for significant water erosion is mostly low with a lesser amount of moderate to high potential occurring on segments which cross mountain ranges. The potential for significant wind erosion is low and moderate. Reclamation potential is distributed across the good to poor range, with a sizeable part of the route having a probability for significant revegetation problems.

4.2.3.1.4 Mojave Desert (MP 390-711)

In the Mojave Desert area the probability for significant water erosion is mostly low with a lesser amount having moderate to high potential on segments crossing mountains or other steep topography. The probability for significant wind erosion is evenly distributed across the low to high range, with the most sizeable area having high potential occurring in California. Reclamation potential is mostly poor, indicating significant potential revegetation problems.

Table 4.2-9
DISTRIBUTION OF POTENTIAL SOILS IMPACTS, KERN RIVER PROPOSAL

		Erosion Potential[1]						Reclamation Potential[2] (miles)[3]		
		Water (miles)[3]			Wind (miles)[3]					
Milepost	Geographic Area	L	M	H	L	M	H	G	F	P
Mainline										
0.0-40.0	Wyoming Basin	21.0	11.0	8.0	0.0	40.0	0.0	4.0	23.0	13.0
40.0-185.0	Middle Rocky Mtns.	39.0	57.0	49.0	81.0	64.0	0.0	5.0	88.0	52.0
185.0-390.0	Basin and Range	155.0	38.0	12.0	90.0	115.0	0.0	61.0	94.0	50.0
390.0-711.0	Mojave Desert	270.0	39.0	12.0	102.0	127.0	92.0	13.0	40.0	268.0
711.0-746.0	Tehachapi Mtns.	18.0	6.0	11.0	4.0	30.0	1.0	13.0	10.0	12.0
746.0-756.1	San Joaquin Valley	8.1	2.0	0.0	0.0	8.1	2.0	8.1	1.0	1.0
Kern River Lateral										
0.0-26.8	San Joaquin Valley	22.0	2.8	2.0	16.0	8.8	2.0	13.0	8.0	5.8
Taft Lateral										
0.0-47.1	San Joaquin Valley	42.0	3.0	2.1	11.0	36.1	0.0	42.0	4.1	1.0

---

[1] Water Erosion Potential

L(low) = less than 5 tons/acre/year (low probability for significant erosion impacts).

M(moderate) = 5 to 20 tons/acre/year (near even probability for significant erosion impacts).

H(high) = greater than 20 tons/acre/year (high probability for significant erosion impacts).

Wind Erosion Potential

L(low) = low probability for significant erosion impact.

M(moderate) = near even probability for significant erosion impacts. Impact potential also dependent upon site specific exposure to prevailing winds.

H(high) = high probability for significant erosion impacts. Impact potential also dependent upon site specific exposure to prevailing winds.

[2] Reclamation Potential (Ratings are based upon trenching with no selective soil handling or other mitigation)

G(good) = good probability for restoring vegetation which will support pre-existing land use. Productivity potential may be somewhat reduced.

F(fair) = near even probability for restoring vegetation which will support pre-existing land use within short periods of time. Time needed for re-establishment is likely to be longer than soils with good potential. Productivity potential may be reduced.

P(poor) = low probability for restoring vegetation which will support pre-existing land use within a short period of time. Time needed for re-establishment is likely to be long. Productivity potential may be reduced.

[3] Cumulative miles for pipeline segment.

4.2.3.1.5 Tehachapi Mountains (MP 711-746)

In the Tehachapi Mountains area the potential for significant water erosion is distributed across the low to high range, with low potential in valleys and on fans and high potential on mountain slopes. The potential for significant wind erosion is mostly moderate. Reclamation potential is evenly distributed across the good to poor range, with about one-third of the route having high potential for significant revegetation problems.

4.2.3.1.6 San Joaquin Valley (MP 746-756)

In the San Joaquin Valley area the potential for significant water erosion is mostly low. The potential for significant wind erosion is mostly moderate. Reclamation potential is mostly good, indicating that only small areas would have significant revegetation problems.

4.2.3.2 Kern River Lateral

The distribution of potential soils impacts that would occur along the Kern River Lateral within the San Joaquin Valley is summarized in Table 4.2-9. The probability for significant water erosion along this segment of the route is mostly low, with high potential occurring only on short segments of the route on steeper slopes. The probability for significant wind erosion is mostly low. Reclamation potential is mostly good and fair, with comparatively short segments having a high probability for significant revegetation problems.

4.2.3.3 Taft Lateral

The distribution of potential soils impacts that would occur along the Taft Lateral within the San Joaquin Valley is summarized in Table 4.2-9. The probability for significant water erosion along this segment of the route is mostly low, with high potential only on short segments of the route on steeper slopes. The probability for significant wind erosion is mostly moderate. Reclamation potential is mostly good.

4.2.3.4 Compressor Stations

Refer to Section 4.2.3.1.1 for a description of potential impacts to soils at Compressor Station No. 1.

Refer to Section 4.2.3.1.3 for a description of potential impacts to soils at Compressor Station No. 3.

Refer to Section 4.2.3.1.4 for a description of potential impacts to soils at Compressor Station No. 5.

4.2.4 Surface Water

Comments made regarding hydrostatic testing in Section 4.2.4, Volume I, for the Mojave project also apply to the Kern River project.

The following itemization of pipeline component specific impacts to perennial streams is primarily based on a stream sensitivity rating. The sensitivity of streams and rivers to pipeline construction is based on the channel gradient, and the gradient of the topographic sideslopes in combination with the width of the floodplain. Streams were given a low rating if channel gradients were less than one percent and had sideslope gradients less than five percent, or had floodplains greater than 50 feet on a side; a moderate rating if channel gradients were between one and three percent, and had sideslopes between five and 20 percent; and a high rating if channel gradients were greater than three percent, or had a sideslope greater than 20 percent. The higher the sensitivity, the greater the chance that significant impacts would occur.

Impacts to surface water resources that would occur during to pipeline construction, operation, and abandonment are classified as significant using criteria derived from government regulatory standards, available scientific documentation, previously prepared EISs and the professional judgement of resource specialists. The following criteria were used to delineate significant impacts to surface water resources:

- o Degradation of water quality to the point that it does not meet all existing state and federal standards;
- o Modification of quantity or quality of stream flow caused by water withdrawals, instream construction, or accidental contamination to the extent that water used by established users is measurably reduced or that critical aquatic habitats support reduced fish populations;
- o Alteration of channel geometry or gradients such that undesirable effects such as aggradation, degradation, or side cutting occurs;
- o The location of permanent above-ground facilities within the 100-year floodplain;
- o Downstream sedimentation affects the operation of irrigation water control structures.

Impacts that would occur to surface water resources due to pipeline construction generally fall into three categories including: increased surface runoff, erosion, and off-site sedimentation resulting from clearance of the ROW; construction through streams and rivers; and the withdrawal and discharge of water associated with hydrostatic testing of the pipeline.

Construction activities within the ROW would increase surface runoff, erosion, and subsequent off-site sedimentation. The potential and magnitude of increase would be proportional to the gradient of the topographic sideslope in addition to the inherent erodibility of the soil. Erosion is discussed in the soils section above. Depending on the size of contributing areas upslope, a substantial quantity of sediment could be transported downslope especially if the trench were left open during a precipitation event and served as a runoff concentrator. This could be a common event due to the nature of summer thunderstorms in the project area. Should an increase in runoff, erosion, and sedimentation occur adjacent to a stream channel, the increase in sediment loading to the stream environment in turn would cause a degradation of water quality and could constitute a significant impact. In mountainous terrain where unstable slopes are common, an increased additional potential for stream sedimentation caused by mass failure of earth materials may occur. Slope stability is discussed in the geology section above.

Construction of the pipeline through flowing perennial and intermittent stream channels would likely result in two types of impacts: the dislodging and subsequent increased transport of channel bed sediments and the alteration of the channel bed configuration and bed material. Alteration of the channel bed could cause disruption of the tenuous balance between stream discharge, amount and kinds of sediment transported, and the size of sediment making up the channel bed, resulting in aggradation and degradation of the channel. Both resultant impacts could constitute significant impacts to water quality and stability of the stream environment unless appropriate mitigation measures are implemented. Pipeline construction through ephemeral channels would increase the amount of available and easily entrained sediment during flows; however, this impact would not be considered significant. Streams may be further subjected to construction impacts if subsurface water contained in alluvium is affected.

Depending on the location and discharge of the water body utilized as a source of water for hydrostatic testing, the withdrawal of water in large quantities could significantly reduce natural flows such that instream water uses and downstream water uses could be impacted. Withdrawal rates could be as high as 7 cubic feet per second (cfs). Generally, water withdrawal would last for a very short period of time. However, if substantial dewatering occurs such that downstream water uses or instream uses were impacted, the impacts would be considered significant. The indiscriminant discharge of water used for hydrostatic testing could negatively impact surface water quality if residual chemicals associated with welding, construction machinery, or pipeline coating were transported with the water and discharge into or near a stream. Erosion of earth materials could occur if the discharge water was allowed to scour unprotected soils. Discharge rates could be as high as 5 cfs. These impacts associated with hydrostatic water discharge would be significant unless appropriate mitigation measures were implemented.

4.2.4.1 Kern River Mainline

4.2.4.1.1 Wyoming Basin

Within the Wyoming Basin the nine perennial stream crossings have low sensitivities relative to channel gradient; however, most of these crossings occur where sideslopes are steep and have moderate to high sensitivities (see Table 3.1-7). Impacts associated with construction across these streams would primarily involve increased sediment loading from exposed soils on the ROW adjacent to the streams. The increased sediment loading would be significant unless appropriate mitigation measures are implemented. Albert Creek has been designated by the Kern River Pipeline Company as a source of water for hydrostatic testing. Since the creek is relatively small, there is a chance that stream discharge would be substantially reduced temporarily. No impacts to downstream irrigation diversion devices or changes in watershed boundaries are expected as a result of pipeline construction.

4.2.4.1.2 Middle Rocky Mountains

Within the Middle Rocky Mountains approximately 35 perennial streams would be crossed. The major perennial streams include the Bear River, Weber River, Provo River, Strawberry River, Diamond Fork, Spanish Fork, and Thistle Creek. Due to the steep and rugged terrain of this region, most of the streams have moderate to high sensitivities relative to both channel gradients and sideslopes. Many of these streams have channel beds resting on or near bedrock. Blasting within the channels of these streams may be required. This, in combination with the relatively high sensitivity of the streams, indicates that a significant increase in sediment loading and channel bed disruption could occur. These impacts could remain significant in the long term unless appropriate mitigation measures are implemented. Stabilization of the disturbed ROW could take two to three years due to the steep terrain and relatively high elevation. Even if mitigation measures were successfully applied, the likelihood that some level of increased sediment loading would continue for a period after construction would be high due to the relatively high sensitivity of the stream environments and steep terrain. Similar impacts as discussed for perennial streams would likely occur to intermittent streams if the quality or quantity of flow was altered. There is a high probability that a significant increase in sediment loading and channel bed disruption would occur in the intermittent/ephemeral stream channels crossed by the pipeline. Sediment loading would affect downstream irrigation uses and reservoir impoundments.

The potential for a significant increase in surface runoff, erosion, and off-site sedimentation would exist within the ROW construction zone due to the steep terrain. Watersheds within this region have very dense drainage networks and therefore, numerous ephemeral, intermittent, and perennial drainage channel crossings would be made. Thus, the increased surface runoff, erosion and off-site sediment transport would result in significant impact to stream environments unless appropriate mitigation measures are implemented.

Numerous areas with perennial surface seepage would likely be affected by construction of the pipeline ROW, particularly in the Strawberry Reservoir area. Water from these seeps ultimately becomes stream flow and therefore, any reduction of water quality in these seep areas would result in water quality reduction in streams unless appropriate mitigation measures are implemented.

Chalk Creek, Weber River, Provo River, Diamond Fork, Spanish Fork River, and Salt Creek have been itemized as potential sources of water for hydrostatic testing. Temporary reductions in stream flow would result during water extraction. The reductions could be substantial in some of the smaller streams such as Chalk Creek and Salt Creek, if withdrawals are done during a low flow period; however, this is unlikely. Discharge of the hydrostatic water could cause additional impacts which were previously described.

4.2.4.1.3 Basin and Range

Approximately six perennial streams would be crossed by the pipeline within the Basin and Range region including Hop Creek, Salt Creek, Chicken Creek, and Sevier River in the northern portion of the region, and Holt Canyon, Spring Creek, Magotsu Creek, and Moody Wash in the southern portion of the region. Chicken Creek, Sevier River, and Chalk Creek have low to moderate sensitivities due to the relatively low topographic relief of their immediate areas, channel gradients, and sideslope gradients. Pipeline construction would also take place adjacent to the west shore of Chicken Creek Reservoir where some increased sediment loading could occur. Consequently, impacts to these streams and the reservoir caused by pipeline construction would be relatively minor, short lived, and therefore not significant. The other creeks that would be crossed in the southern portion of the region have moderate to high sensitivities due to the high relief, and steep topographic and channel gradients. The potential for substantial increases in sediment loading due to increased surface runoff and erosion from the ROW as well as trenching through the streams would occur at these creeks and would constitute a significant impact unless appropriate mitigation measures are implemented. The nature of the impacts was previously described above.

Chicken Creek Reservoir, Sevier River, Newcastle Reservoir, and Santa Clara River have been identified as potential sources of water within this region for hydrostatic testing of the pipeline. Water withdrawal from Chicken Creek Reservoir, Sevier River, and Newcastle Reservoir would have little impact on the quantity of or flow in these water bodies. However, water withdrawal from the Santa Clara River would substantially reduce flows temporarily which could be significant if total or near total dewatering occurred. In addition, downstream water users would likely be impacted.

Numerous intermittent and ephemeral channels would be crossed by the pipeline. Impacts similar to those described previously would likely occur. However, since most intermittent and ephemeral streams within this region have low sensitivities to pipeline construction within the stream channels and have little if any flow, no significant impact to these streams is expected unless the impact is carried downstream to a perennial stream which is highly unlikely.

Approximately seven irrigation canals or ditches would be crossed by the pipeline. No significant impact to water quality or quantity is expected provided that construction occurs over a short period or when the ditches or canals are not transporting water.

No changes in watershed boundaries or impact to irrigation diversion structures are anticipated as a result of pipeline construction.

4.2.4.1.4 Mojave Desert

Several large streams which approach a perennial condition would be crossed including Beaver Dam Wash, Toquop Wash, Weiser Wash, Muddy River, and Las Vegas Wash. These streams are considered sensitive because they offer the majority of surface water in the area and support wetlands and riparian zones which are unique in the area. Numerous additional intermittent and ephemeral streams would be crossed. The sensitivities of the streams to crossing in terms of channel gradient and topographic sideslope are considered low. When flows do occur they tend to be highly turbid and near their carrying capacity with large dissolved wash and bed loads. Consequently, the short-term increase in sediment loading associated with pipeline construction would not be considered significant.

Newcastle Reservoir, Santa Clara River, Lake Mead, and the Los Angeles Aqueducts have been identified as potential sources of water for hydrostatic testing of the pipeline. Except for the Santa Clara River where a substantial short-term reduction of flow would occur, no significant impact to these surface water bodies is expected. The discharge of the water could cause substantial impact as previously described.

The Los Angeles Aqueducts west of Mojave, California, would be crossed by the pipeline. Because of the size of the concrete structure, the volume of continuous flow, and the importance of the flow it is assumed that the pipeline crossing would be made either over the canal on a bridge, or placed under the structure by directional drilling. No impact would occur to this resource under this assumption.

No changes in watershed boundaries or impacts to irrigation diversion structures are anticipated as a result of pipeline construction within the Mojave Desert region.

No significant impact would occur to the surface water resources due to pipeline construction, operation, and abandonment within the Mojave desert.

4.2.4.1.5 Tehachapi Mountains

Approximately nine intermittent streams would be crossed by the pipeline within the Tehachapi Mountains area. Due to the steep mountainous terrain of the area and the steep channel and sideslope gradients, these streams are all considered to have high sensitivities to pipeline construction. The exposed soils and construction activity in the ROW adjacent to stream channels would greatly increase sediment loading to the streams until the slopes stabilized or were revegetated. Construction activity in the channels would alter channel bed configurations and greatly increase the amount of sediment loading if flows occurred during construction, or increase the amount of available, easily entrained sediment. Thus, significant impact could occur to the streams unless appropriate mitigation measures are implemented.

No increase or decrease in flows within these streams is anticipated due to construction, operation, and abandonment of the pipeline. No surface water bodies within the Tehachapi Mountains have been identified as being potential sources of water for hydrostatic testing. Water for hydrostatic testing would probably be obtained from the Los Angeles Aqueducts on the east side of the area, or from the California Aqueduct and East Side Canal on the west. If this water was discharged within the area, a small increase in stream flow would occur at some unknown location. Additional impacts associated with the discharge of water would occur, the nature of which was previously described.

No changes in watershed boundaries would occur and no impacts to irrigation diversion structures are anticipated as a result of pipeline construction.

4.2.4.1.6 San Joaquin Valley

No significant impacts to surface water resources are anticipated as a result of pipeline construction within the San Joaquin Valley area. One intermittent stream, Caparell Creek, and several small ephemeral channels would be crossed with only minimal impact in terms of channel bed disruption and sediment loading. No other impacts of major consequence would occur as a result of pipeline construction, operation, and abandonment in this area. The Kern River would be crossed by the Kern River Lateral at a point where its sensitivity to crossing is low with respect to channel bed gradient and sideslope. Consequently, significant impacts are not anticipated as a result of constructing the pipeline at this point. Increased sediment loading to the river would occur but would last only in the short run. No significant impact is anticipated as a result of constructing the Kern River Lateral under or across canals.

4.2.5 Groundwater

Potential impacts to groundwater resources that would occur due to pipeline construction, operation, and abandonment were classified as significant or not significant using criteria derived from available scientific documentation (including previously prepared related environmental impact statements) and the professional judgement of resource specialists. Impacts were considered potentially significant if:

- The depth of groundwater was shallow (<10 feet) and served as a major source of water for local industrial, agricultural, or domestic use (high potential);
- The depth to groundwater was moderate (10-50 feet) and local usage was high or the depth to groundwater was shallow (<10 feet) and local usage was moderate (medium potential);
- The depth to groundwater was moderately great (50-100 feet) and local usage was low (low potential).

Impacts were considered not significant if:

- The depth to groundwater was great (>100 feet);
- Groundwater quality was sufficiently poor (total dissolved solids concentrations greater than 2,000 milligrams per liter) to preclude widespread development;
- Groundwater usage in the area was currently low and was not anticipated to increase significantly in the future.

Potential groundwater impacts that may occur include contamination due to fuel or chemical spills and lowering or alteration of the water table. These impacts would be expected to be limited to areas in the immediate vicinity of and hydraulically downgradient from the pipeline and within the affected aquifer. An exception would be if a significant chemical spill occurred in surface water. This contamination could be carried downstream and subsequently pollute aquifers that are not associated with the pipeline route. Areas of highest potential impact are those locations that overlie a shallow aquifer that has been extensively developed locally as a water supply. Specific measures are recommended to minimize the possibility of accidental groundwater contamination.

During excavation and installation of the pipeline, shallow aquifers could be disrupted temporarily due to dewatering. Effects from these operations would be short-term and would go unnoticed except in wells completed in the same aquifer in the immediate vicinity of the pipeline.

A potential also exists that flow conditions in shallow aquifers (including mountain slopes) could be altered due to the presence of the trench in which the pipeline is laid. If the material backfilled into the trench was less permeable than the surrounding material, the trench would serve as a barrier to groundwater flow. If it was more permeable, the trench would serve as an avenue for enhanced flow. The effect could be small or large, thus affecting a localized or extensive area. In the case of mountainous terrain crossed by the mainline in northern Utah, slope instability areas are uniform and cover many continuous acres. A change in groundwater flow on a portion of these acres has the potential to affect the total unstable slope. Bulkheads or ditch plugs would be installed on slopes to minimize these effects. In mountainous terrain, the effects of trench excavations on groundwater movement could significantly affect slope stability.

Upon abandonment, the pipeline would be purged. The purging medium would be treated to remove contaminants prior to discharge. If reasonable precautions were used, abandonment would have negligible impacts on groundwater.

Nearby springs in mountainous areas could be adversely affected by blasting and excavation. Specific measures are recommended to minimize any significant impact to important springs. Specific groundwater impacts that could potentially occur due to construction, operation, and abandonment of the Kern River Proposal are summarized in Table 4.2-10.

4.2.5.1 Kern River Mainline

As noted in Table 4.2-10, the highest potential for groundwater impacts will occur immediately southeast of Las Vegas, Nevada, and in two areas west of Barstow, California. In both locations, the depth to groundwater is shallow, the water is of good quality, and groundwater usage in the area is high. Locations of quality, and groundwater usage in the area is high. Locations of medium potential for significant impact include two areas near Levan, Utah, and near Scipio, Utah, where high use occurs with a moderately deep water table.

Table 4.2-10

POTENTIAL GROUNDWATER IMPACTS, KERN RIVER PROPOSAL

Milepost	Degree of Potential Impact High	Medium	Low	Comments
50, 67-70	-	-	X	Along perennial rivers, low use, moderate depth
176	-	-	X	Passes near Bradley Spring (public water supply)
190	-	X	-	High use, moderate depth to water
195	-	X	-	Several major water supply springs in area
214-219	-	X	-	High use, moderate depth to water
320-350	-	-	X	High use, moderately great depth to water
500	X	-	-	High use, good quality, shallow water
580, 595, 625	-	-	X	Shallow water, low use
655, 690	X	-	-	Shallow water, high use in area
Kern River Lateral				
0-26.8	-	-	X	Great depth to water, high use
Taft Lateral				
0-47.1	-	-	X	Great depth to water, high use

4.2.6 Freshwater Biology

Principal impacts on aquatic environments which would result from construction of the proposed pipeline include increased sedimentation, substrate removal, and habitat alteration. Effects of these impacts on aquatic organisms would include reduction of algae and macrophyte populations, decreased macroinvertebrate abundance, and displacement and potential reduction of fish populations [Murphy, et al., 1981; Reed, 1971].

Impacts of pipeline construction would be relatively short-term and primarily related to the amount of sediments introduced into the stream, how far they are transported and the quality or importance of the aquatic resource affected.

Increased suspended sediments can decrease primary and benthic invertebrate production by siltation of benthic habitat. Fish could also be affected by increased sedimentation, which can decrease food availability (i.e., benthic invertebrates), feeding efficiency, and the amount and quality of spawning or juvenile rearing habitat. The type and quantity of sediments introduced and transported within a stream is variable, dependent upon stream gradient, bed type, hydrology, size of floodplain, steepness of sideslopes and extent of streamside vegetation.

Actual loss of habitat as a result of removal of streamside vegetation or trenching of benthic habitat would be relatively minor and would not exert a significant impact.

The impacts of pipeline construction on aquatic communities at stream crossings are presented in Table 4.2-11. Impacts to aquatic communities were considered significant if:

- o A pipeline crossing occurred on a Class A stream. (See Table 3.9-1 for class definitions)
- o A high potential for sedimentation existed at a crossing of a Class B stream.

Impacts to aquatic communities would not be considered significant if:

- o A pipeline crossing occurred on a Class C, D, or U stream.
- o A low to moderate potential for sedimentation existed at a crossing of a Class B, C, D, or U stream.

Sedimentation potential was based on hydrologic sensitivity values presented in Table 3.1-7. Streams with high gradient (>3 percent) or steep sideslopes (>20 percent) were considered to have high sedimentation potential.

Other potential impacts associated with construction of the pipeline include altered stream flow and fish mortality associated with hydrostatic testing of the pipeline. The potential for toxic fuel spills exists due to storage of petroleum products in the area during construction. Increased fishing pressure may result from increased public access into the area.

Table 4.2-11

SIGNIFICANCE OF IMPACTS ON AQUATIC COMMUNITIES, KERN RIVER PROPOSAL

State	County	Stream	Approximate Milepost	Impacts[1]
Wyoming Basin Region (MP 0-40)				
Wyoming	Uinta	Little Muddy Creek	13.7	NS
		Little Muddy Creek	14.8	NS
		Little Muddy Creek	16.5	NS
		Albert Creek	17.1	NS
		Albert Creek	18.0	NS
		Albert Creek	23.2	NS
		Clear Creek	27.1	NS
		Clear Creek	27.6-28.3	NS
Middle Rocky Mountains Region (MP 40-185)				
Wyoming	Uinta	Bear River	48.4	S
		Coyote Creek	53.2	NS
		Clifton Hollow	55.3	NS
		Sage Creek Draw	58.0	NS
		Yellow Creek	60.4	NS
		Basin Creek	64.1	NS
Utah	Summit	Chalk Creek	67.5	NS
		East Fork	70.1	NS
		Fish Creek	74.1	NS
		South Fork Chalk Crk	79.0	NS
		Whites Creek	88.1	S
		Weber River	89.9	NS
		Beaver Creek	95.9	S
	Wasatch	Provo River	99.8	S
		Big Pole Creek	103.8	NS
		Lake Creek	112.0	S
		Strawberry River	114.3	S
		Wide Hollow	114.9	NS
		Mill B Canyon	116.9	S
		Strawberry River	119.2	S
		Bjorkman Hollow	120.0	NS
		Stawberry River	121.2	S
		Hobble Creek	122.5	NS

Table 4.2-11 (continued)

SIGNIFICANCE OF IMPACTS ON AQUATIC COMMUNITIES,
KERN RIVER PROPOSAL

State	County	Stream	Approximate Milepost	Impacts[1]
	Utah	Wanrhodes Canyon	141.6	S
		Little Diamond Creek	142.6	S
		Diamond Fork	146.2	NS
		Diamond Fork	147.2	NS
		Spanish Fork	148.8	S
		Crab Creek	152.0	NS
		Anderson Hollow	154.7	NS
		Bennie Creek	155.9	S
		Nebo Creek	159.4	NS
	Juab	Hop Creek	175.2	S
		Salt Creek	176.5	S
		Salt Creek	180.2	S
Basin and Range Region (MP 185-390)				
Utah	Juab	Chicken Creek	197.7	NS
		Sevier River	202.6	NS
	Washington	Holt Canyon	361.8	NS
		Spring Creek	364.0	NS
		Magotsu Creek	373.9	NS
		Moody Wash	376.9	NS
Mojave Desert Region (MP 390-711)				
Nevada	Clark	Muddy River	446.7	NS
San Joaquin Valley Region (MP 746-ends of both laterals)				
Calif.	Kern	California Aqueduct	24.6 (Taft Lateral)	NS
		Kern River	24.1 (Kern River Lateral)	NS

---

[1] S = significant
NS = not significant

The impact of altered stream flow cannot be defined at this time as only potential sources of water have been identified and the timing of withdrawals has not been specified. The potential impact of direct fish mortality as a result of hydrostatic testing, fuel spills and increased fishing pressure would not be significant if adequate mitigation measures were initiated.

4.2.6.1 Wyoming Basin (MP 0-40)

Three streams would be crossed in at least eight locations along the mainline within this region. However, due to the low value of the streams crossed, no significant impacts are expected to occur.

4.2.6.2 Middle Rocky Mountains (MP 40-185)

In the Middle Rocky Mountain region, 35 crossings would be made on 31 different perennial streams. Significant impacts could result from construction activities at 16 of the stream crossings. Two of the streams crossed, the Provo River and Beaver Creek, are Class A stream sections. These streams are considered particularly sensitive due to the high quality spawning and nursery areas present. The State of Utah considers these streams to be critical habitat for the game species present. The remaining 14 streams support Class B fisheries, but crossings would be located in areas that have potentially high sedimentation effects on the streams.

Four streams crossed by this section of the pipeline support sensitive species. The Bonneville cutthroat and the leatherside chub, both federal candidate species, occur in drainages within this region. No significant impacts would be expected to occur to the Bonneville cutthroat as no populations are known to occur near the proposed crossings. The leatherside chub could be significantly impacted at one crossing within the region.

4.2.6.3 Basin and Range (MP 185-390)

Six perennial streams and numerous washes would be crossed within the Basin and Range region. No significant impacts associated with construction of the pipeline are expected to occur due to the limited stream resources present.

4.2.6.4 Mojave Desert (MP 390-711)

One perennial stream would be crossed within the Mojave Desert region. Several sensitive species do occur within this region (Table 3.1-11), including one federally listed threatened species, the Moapa dace. However, these species all occur primarily upstream of the proposed crossing and would not be significantly impacted by the crossing.

4.2.6.5 Tehachapi Mountains and San Joaquin Valley (MP 711-end)

From MP 711 to the ends of the laterals in California, the only aquatic resources crossed would be the California Aqueduct and the Kern River. No significant impacts would be expected at either site.

4.2.7 Terrestrial Biology

4.2.7.1 Vegetation

Impacts on vegetation associated with pipeline construction were classified as significant or non-significant using criteria developed from governmental regulatory standards, available scientific documentation, reclamation technology and objectives, and the professional judgement of resource specialists. The following impacts were considered significant:

- Removal of vegetation that, following reclamation, would not have an adequate cover of vegetation and species composition to support pre-existing land use including grazing, wildlife habitat, recreation, and agricultural operations.
- Loss or disturbance of agricultural land which lasts for one year or more and loss of commercially valuable timber.
- Loss or disturbance of riparian and wetland vegetation, as well as other communities considered to be economically important, rare, unique or sensitive by federal, state, or local agencies or municipalities, and special interest groups.
- Reduction in numbers of individuals of sensitive plant species or disturbance of suitable habitat with or without known occurrence judged important to the survival of those species.

Impacts caused by pipeline construction and associated activities are categorized according to significance:

Class I:	Significant adverse impacts that could not be mitigated or avoided.
Class II:	Significant adverse impacts that could be feasibly mitigated or avoided.
Class III:	Adverse but not significant impacts that could be feasibly mitigated or avoided.
Class IV:	Beneficial impacts.

Denudation of vegetation along the 100-foot pipeline ROW would impact all vegetation types traversed by the pipeline routes. The duration of this loss would depend on whether large woody shrubs and trees were present in the operational ROW and the revegetation potential of a given community type. For the Kern River project it was assumed that a 50-foot wide operational ROW would be maintained by not allowing large woody shrubs and trees to re-establish within the ROW. Therefore, most vegetation loss across the 100-foot construction ROW within community types with fair or better revegetation potential not containing large woody shrubs or trees would be short term. Loss within vegetation types with fair or better revegetation potential containing large woody shrubs and trees would be long term (life of project) within the operational ROW, and short term within the balance of the construction ROW since the woody species would re-establish relatively quickly within the life of the project. Vegetation losses within vegetation types with fair or better revegetation potential would be classified as Class III impacts regardless of whether they are long- or short-term losses except for the oaks in the digger pine-oak woodland type. Loss of these individuals would be considered a Class II impact since they could be avoided. The forb, grass, and shrub components of the digger pine-oak woodland would re-establish relatively quickly.

The duration of impacts associated with removal of vegetation types would vary widely with respect to the inherent revegetation potential of each vegetation type, which is generally inversely related to aridity [Vasek, et al., 1975]. Revegetation of arid and semiarid communities occurring in the Mojave Desert is difficult and would require 70 years or more before a natural state is approached [Lathrop and Archbold, 1980; Vasek, et al., 1975].

Loss within the following vegetation types would be considered Class I impacts: blackbrush scrub, Joshua tree woodland, Mojavean creosote bush scrub, Mojavean juniper woodland and scrub, Mojavean shadscale scrub, desert salt bush scrub, and western Mojave Desert Mojave saltbush unusual plant assemblage. Loss of these types would be considered a permanent Class I impact since construction of the project in these types would be required regardless of route location within the Mojave Desert. Loss within the wetland/riparian, digger pine-oak woodland, and agricultural land types including intensively managed forests (montane forest) would be considered a Class II impact. Loss within the following types would be considered a Class III impact: mixed desert scrub, sagebrush scrub, pinyon-juniper woodland, mountain brush, Utah grassland, and valley and foothill grassland. The loss of individual Joshua trees (Joshua tree woodland), blue oaks (digger pine-oak woodland), and valley oaks (digger pine-oak woodland) would be considered Class II impacts since they are could be mitigated by avoidance and/or transplanting in the case of Joshua trees. These species are very difficult to regenerate in the long term and loss would essentially be permanent.

The proposal, including the mainline, Kern River Lateral, Taft Lateral, and three compressor stations, would denude a total of 10,210 acres of vegetation within 17 vegetation community types. Of this total, 3,970 acres of loss would be considered Class I impact, 1,810 acres would be Class II impact, and 4,430 acres would be Class III impact. Table 4.2-12 summarizes the loss of vegetation that would occur due to construction of each component of the proposal.

Major portions of the ROW would be susceptible to the establishment of weedy and noxious plant species. Once established, the prolific and competitive nature of these undesirable species may preclude establishment of desirable species. The establishment of these undesirable species would be considered a Class II impact since measures could be implemented to effectively control or eradicate the species.

Land uses and values associated with vegetation that would be impacted as a result of ROW clearing include livestock grazing, agricultural operations, timber harvesting or timber stand improvement, and wildlife habitat. Except for agricultural and timber operations, these topics are discussed elsewhere. Impacts to agricultural lands would include loss of existing crops and decrease in productivity of the land. With proper soil handling techniques and the timing of construction to occur during the dormant season, the loss of productivity should be short term and therefore Class II. Long-term loss may occur to vineyards and orchards since they are woody in nature and not readily replaced. However, these losses would be mitigable through direct compensation. Denudation of forest stands where improvements have been made and where merchantable timber would be lost would last throughout the life of the project because the operational ROW would be kept clear of large woody vegetation to facilitate access for maintenance and repair. These Class II impacts could be minimized through compensation or sale of the timber removed within the ROW. Montane forest disturbed on USFS lands may be subjected to specific requirements differing from those proposed by the applicant.

Impacts that would occur to plant species of special concern include direct impacts involving the death or destruction of an individual or population, and impacts involving the destruction and reduction of suitable habitat with or without the occurrence of individuals or populations. Both impacts would be considered significant since they may result in further jeopardizing the existence of the species. These impacts would be categorized as either Class I or Class II depending on the feasibility and success of implementing appropriate mitigation measures.

The ability to assess a definite impact to species of special concern depends on the level of detail available on the species.

Table 4.2-12

VEGETATION TYPES AND DENUDED ACREAGES, KERN RIVER PROPOSAL

Component/ Geographic Region	Vegetation Type	Impact[2] Class	Denudation[1] (Acres)			
			Short Term[3]	Long Term[4]	Permanent[5]	Total
Mainline						
Wyoming Basin	Mixed desert scrub	III	181.7	0	0	181.7
	Sagebrush scrub	III	302.9	0	0	302.9
	Wetland/riparian	II	0.2	0	0	0.2
		Subtotal	484.8	0	0	484.8
Wasatch Mtns	Sagebrush scrub	III	545.5	0	0	545.5
	Pinyon-Juniper woodland	III	72.7	72.8	0	145.5
	Montane forest	II	236.3	236.4	0	472.7
	Agricultural land	II	48.5	0	0	48.5
	Mountain brush	III	236.4	236.3	0	472.7
	Wetland/riparian	II	72.7	0		72.7
		Subtotal	1212.1	545.5	0	1757.6
Basin and Range	Mixed desert scrub	III	133.3	0	0	133.3
	Agricultural land	II	400.0	0	0	400.0
	Sagebrush scrub	III	1127.3	0	0	1127.3
	Utah grassland	III	169.7	0	0	169.7
	Pinyon-Juniper woodland	III	266.6	266.7	0	533.3
	Wetland/riparian	II	24.2	0	0	24.2
	Blackbush scrub	I	0	0	97.0	97.0
		Subtotal	2121.1	266.7	97.0	2484.8
Mojave Desert	Blackbrush scrub	I	0	0	375.7	375.7
	Joshua tree woodland	I	0	0	315.1	315.1
	Mojavean creosote bush scrub	I	0	0	2569.4	2569.4
	Agricultural land	I	151.5	0	0	151.5
	Mojavean juniper woodland and scrub	I	0	0	24.2	24.2
	Mojavean shadscale scrub	I	0	0	24.2	24.2
	Desert saltbush scrub	I	0	0	12.1	12.1
	Wetland/riparian	II	30.3	0	0	30.3
	Mojave saltbush [6]	I	0	0	387.8	387.8
		Subtotal	181.8	0	3708.5	3890.3
Tehachapi Mtns	Mojavean creosote bush scrub	I	0	0	60.6	60.6
	Mojavean juniper woodland and scrub	I	0	0	60.6	60.6
	Digger pine-oak woodland	II	0	0	229.8	229.8
	Wetland/riparian [7]	II	0.3	0.3	0	0.6
	Valley and foothill grassland	III	72.6	0	0	72.6
		Subtotal	72.9	0.3	351.0	424.2
San Joaquin Valley	Valley and foothill grassland	III	60.2	0	0	60.2
	Agricultural land	II	60.2	0	0	60.2
	Wetland/riparian [7]	II	0.4	0.4	0	0.8
		Subtotal	120.8	0.4	0	121.2

Table 4.2-12 (continued)

VEGETATION TYPES AND DENUDED ACREAGES, KERN RIVER PROPOSAL

Component/ Geographic Region	Vegetation Type	Impact[2/] Class	Denudation [1/] (Acres) Short Term[3/]	Long Term[4/]	Permanent[5/]	Total
Kern Lateral						
San Joaquin Valley	Valley and foothill grassland	III	157.6	0	0	157.6
	Agricultural land	II	157.6	0	0	157.6
	Wetland/riparian [7/]	II	6.0	6.1	0	12.1
		Subtotal	321.2	6.1	0	327.3
Taft Lateral						
San Joaquin Valley	Valley and foothill grassland	III	436.2	0	0	436.2
	Agricultural land	II	145.3	0	0	145.3
	Wetland/riparian	II	0.2	0	0	0.2
		Subtotal	581.7	0	0	581.7
COMPRESSOR STATIONS:						
Station No.1 (Wyoming basin)	Mixed desert scrub	III	0	45.0	0	45.0
Station No. 3 (Basin and Range)	Utah grassland	III	0	45.0	0	45.0
Station No. 5 (Mojave Desert)	Joshua tree woodland/ Mojavean creosote bush scrub	I	0	0	45.0	45.0
		Subtotal	0	90	45.0	135.0
Summary by Vegetation Type						
	Mixed desert scrub	III	360.0	0	0	360.0
	Sagebrush scrub	III	1975.7	0	0	1975.7
	Pinyon-juniper woodland	III	339.3	339.3	0	678.6
	Wetland riparian	II	134.3	6.8	0	141.1
	Montane forest	II	236.3	236.4	0	472.7
	Agricultural land	II	963.1	0	0	963.1
	Mountain brush	III	236.4	236.3	0	472.7
	Utah grassland	III	214.7	0	0	214.7
	Blackbrush scrub	I	0	0	472.7	472.7
	Joshua tree woodland	I	0	0	337.1	337.1
	Mojavean creosote bush scrub	I	0	0	2653.0	2653.0
	Mojave saltbush	I	0	0	387.8	387.8
	Mojavean juniper woodland and scrub	I	0	0	84.8	84.8
	Mojavean shadscale scrub	I	0	0	24.2	24.2
	Desert saltbush scrub	I	0	0	12.1	12.1
	Digger pine - oak woodland	II	0	0	229.8	229.8
	Valley and foothill grassland	III	726.6	0	0	726.6
		TOTAL	5186.4	818.8	4201.5	10206.7

Table 4.2-12 (continued)

VEGETATION TYPES AND DENUDED ACREAGES, KERN RIVER PROPOSAL

Component/ Geographic Region	Vegetation Type	Impact[2] Class	Denudation[1] (Acres) Short Term[3]	Long Term[4]	Permanent[5]	Total
Summary by Impact Class						
	Class	I	0	0	3971.7	3971.7
	Class	II	1333.7	243.2	229.8	1806.7
	Class	III	3852.7	575.6	0	4428.3
	Class	IV	0	0	0	0
		TOTAL	5186.4	818.8	4201.5	10206.7

---

[1] vegetation loss assuming a 100-foot wide construction ROW and a 50-foot wide operational ROW.

[2] see definitions at beginning of section.

[3] short-term loss = vegetation loss within community types with fair or better revegetation potential; vegetation loss within total 100-foot wide construction ROW if large woody shrubs or trees not present; vegetation loss short term within the 50-foot wide portion of the construction ROW not used for operation with large woody shrubs and trees present; vegetation loss would not be significant.

[4] long-term loss = loss of vegetation within community types with fair or better revegetation potential containing large woody shrubs or trees present in operational ROW (50-foot wide) which would hamper operations and, therefore, would not be allowed to re-establish in the operational ROW during the life of the project; loss would not be significant.

[5] permanent loss = loss of vegetation within community types with poor or worse revegetation potential; vegetation loss would be significant.

[6] Western Mojave Desert Mojave saltbush unusual plant assemblage.

[7] contains Great Valley mixed riparian forest.

Appendix C lists all the known species of concern that may occur along the proposed routes. The clay phacelia, red rock tarweed, Bakersfield saltbush, striped adobe lily, Tulare pseudobahia, and California jewel flower were classified as species of greatest concern since they are legally protected. Their status and general locations were presented in Table 3.1-14. Field surveys were conducted by qualified botanists in June and July, 1986 for clay phacelia, red rock tarweed, California jewel flower, and Bakersfield saltbush along the estimated location of the proposed pipeline routes. The pipeline routes were not staked on the ground prior to the survey, thus introducing an element of uncertainty as to the actual location of the ROW. At the time of the survey, Bakersfield beavertail cactus was believed to have a high potential of being listed by the State of California. Therefore, it was also surveyed for, but has not yet been listed. Similarly, at the time of the survey it was not known that the striped adobe lily and the Tulare pseudobahia would be listed by the State of California. These species were not surveyed for.

The other plant species of concern occur in the general areas that the pipeline would traverse and thus may be adversely impacted. These species were not surveyed for and thus the potential impact on these species can only be assessed based on the existing data base. The potential occurrences of these species and associated habitats are presented in Appendix C.

The following discussion presents information on Class I and II impacts only for each component of and geographic region traversed by the Kern River Proposal.

4.2.7.1.1 Kern River Mainline

Wyoming Basin (MP 0-40)

General Vegetation. No Class I impacts would occur. Approximately 0.2 acre of wetland/riparian vegetation would be lost (Class II).

Plant Species of Special Concern. Within the Wyoming Basin region, only one federal candidate species, locoweed, would potentially be impacted by pipeline construction. It is not known whether individuals or a population would be affected. However, habitat required by this candidate species would be disturbed or lost. Consequently, the potential for significant impact as a result of pipeline construction is high (Class II).

Middle Rocky Mountains (MP 40-185)

General Vegetation. No Class I impacts would occur. Approximately 590 acres of Class II impacts would occur consisting of 475 acres of montane forest, 50 acres of agricultural land, and 65 acres of wetland/riparian.

Plant Species of Special Concern. Within the Middle Rocky Mountain region, one federally listed species, clay phacelia, and one federal candidate species would potentially be impacted by the pipeline project. Field surveys were conducted for clay phacelia in areas previously identified as potential habitat. No individuals or suitable habitat were found. No significant impact to this species would occur. Deseret milkvetch, the candidate species, would likely be significantly impacted by the construction of the pipeline (Class II).

Basin and Range (MP 185-390)

General Vegetation. Approximately 97 acres of blackbrush scrub, more typically a Mojave Desert region vegetation type, would be lost representing a Class I impact. Approximately 425 acres of Class II impacts would occur consisting of 400 acres of agricultural land and 25 acres of wetland/riparian vegetation.

Plant Species of Special Concern. Within the Basin and Range region, five federal candidate species would likely be impacted by the pipeline project. Habitat required by each of these species would likely be traversed by the pipeline, and therefore, the potential for significant impact is high (Class II).

Mojave Desert (MP 390-711)

General Vegetation. Approximately 3,710 acres of Class I impact would occur consisting of loss of Mojave Desert vegetation types excluding agricultural land and wetland/riparian (Class II). Class II impacts would occur in approximately 180 acres.

Plant Species of Special Concern. Within the Mojave Desert region, fifteen federal candidate species, including species of special concern to the CNPS, and a California state protected species, red rock tarweed, are likely to be impacted by the pipeline project. Three of these species, Ruby globemallow, Jaeger milkvetch, and desert cymopterus, are known to occur along the pipeline route and, therefore, would be significantly impacted. The other 11 species are known to occur in the general area of the pipeline project. Suitable habitat would likely be traversed by the pipeline (3,375 acres). Thus, the potential for significant impact is high for these species in this region (Class II).

Field surveys were conducted for red rock tarweed in areas containing suitable habitat. No individuals were found along the estimated location of the proposed route. However, any seeps and springs can be assumed to be suitable habitat, and consequently, significant impact (Class II) could occur should suitable habitat be affected by pipeline construction.

Tehachapi Mountains (MP 711-746)

General Vegetation. Approximately 120 acres of Class I impact would occur consisting of 60 acres each of Mojavean creosote bush scrub and juniper woodland and scrub. These types are more typical of the Mojave desert than the Tehachapi Mountains. Approximately 230 acres of Class II impacts would occur including losses of digger pine-oak woodland, agricultural land, and wetland/riparian.

Plant Species of Special Concern. Within the Tehachapi Mountains region, four candidate species, including species of special concern to CNPS, are known to occur in the general area of the pipeline within this region. Required habitat would be affected by the pipeline project, and therefore, a high potential for significant impact to these species exists (Class II). Included in these species are the California jewel flower, striped adobe lily, and Tulare pseudobahia, which are California state listed species. Field surveys were conducted for California jewel flower, but not the other two species within the Tehachapi Mountains. It is not known whether individuals occur along this portion of the line since the survey was completed too late in the year to identify the annual species. However, this segment of the line is considered to be suitable habitat and therefore, destruction or disturbance of the habitat (115 acres) could significantly impact the species (Class II).

San Joaquin Valley (MP 746-756)

General Vegetation. Approximately 61 acres of Class II impacts would occur including one acre of Great Valley mixed riparian forest (a wetland/riparian type) and 60 acres of agricultural land. Some of the agricultural land disturbance would involve vineyards and orchards where longer duration interruption of agricultural operations could occur. The loss of any of the large woody species contained in the riparian zones would be considered a Class II impact since the individuals could be avoided.

Plant Species of Special Concern. Within the San Joaquin Valley region, sixteen candidate species, including species of special concern to CNPS, would likely be impacted by the pipeline project. Only one of these species, Comanche Point layia, is known to occur along the pipeline route and would be significantly impacted by construction of the pipeline route. The other species, including the California state listed species California jewel flower, striped adobe lily, Tulare pseudobahia, and Bakersfield saltbush, are not known to occur along the pipeline route. However, suitable habitat would be impacted resulting in a high potential of significant impact to these species (Class II).

Field surveys were conducted for the California state listed species, California jewel flower and Bakersfield saltbush, along the pipeline route. No individuals were found; however, a small amount of suitable habitat (less than five acres) was identified. Therefore, there is a high potential that construction of the pipeline could significantly impact (Class II) these species through the loss of habitat.

4.2.7.1.2 Kern River Lateral

General Vegetation. Approximately 170 acres of Class II impact would occur, including 12 acres of riparian zone (Great Valley mixed riparian forest) where the pipeline route would cross the Kern River, and 158 acres of agricultural land. Many of the agricultural lands that would be disturbed would include vineyards and orchards where longer duration of interruption of agricultural operations could occur. The loss of any of the large woody species contained in the riparian zones would be considered a Class II impact since the individuals could be avoided.

Plant Species of Special Concern. Sixteen candidate species, which are also of special concern to the CNPS, are known to occur in the general area of the pipeline route including the California state listed species California jewel flower, Bakersfield saltbush, striped adobe lily, and Tulare pseudobahia. Two species, Bakersfield saltbush and Bakersfield beavertail cactus, are known to occur in close proximity to the pipeline route. Field surveys were conducted for California jewel flower, Bakersfield beavertail cactus, and Bakersfield saltbush. No individuals of these species were found in or adjacent to the estimated location of the ROW. However, suitable habitat for these species was identified (65 acres). Therefore, there is a high potential that construction of the pipeline could significantly impact these species through the loss of suitable habitat (Class II).

4.2.7.1.3 Taft Lateral

General Vegetation. Approximately 145 acres of Class II impacts would occur involving agricultural land. Many of the agricultural lands that would be disturbed would include vineyards and orchards where longer duration of interruption of agricultural operations could occur.

Plant Species of Special Concern. Fifteen federal candidate species, including species of concern to CNPS and the California state listed species California jewel flower, Bakersfield saltbush, striped adobe lily, and Tulare pseudobahia, are known to occur in the vicinity of the pipeline route within this region. One species, Comanche Point layia, is known to occur near the pipeline route. Consequently, this species would be significantly impacted by pipeline construction (Class II). In addition, the pipeline would traverse suitable habitat of these species in this region, and thus, there is a high potential that these species would be significantly impacted (Class II). Field surveys were conducted for California jewel flower, Bakersfield beavertail cactus, and Bakersfield saltbush along the route. No individuals of these species were found in or adjacent to the estimated location of the ROW. However, 291 acres of suitable habitat was identified along several segments of the route. Therefore, there is a high potential that construction of the pipeline could significantly impact these species through the loss of suitable habitat (Class II).

4.2.7.1.4 Compressor Stations

General Vegetation. No significant impacts would occur due to construction of Stations No. 1 and 3. Construction of Station No. 5 would result in the loss of approximately 45 acres of Mojave Desert vegetation (Mojavean creosote bush scrub and Joshua tree woodland), which would be a Class I impact.

Plant Species of Special Concern. One federal candidate species may be impacted by the construction of the proposed Compressor Station No. 1. Two federal candidate species may be impacted by the construction of the proposed Compressor Station No. 3. Two federal candidate species, including wild buckwheat, which is designated endangered in the State of Nevada, may be impacted by construction of Compressor Station No. 5.

4.2.7.2 Wildlife

Potential impacts to wildlife associated with the construction of the proposed natural gas pipeline can be grouped into four categories: 1) direct impacts to individuals or populations incurred during the construction period; 2) direct impacts to wildlife habitat; 3) indirect impacts associated with increased access; and 4) residual impacts associated with operation of the pipeline.

Direct impacts to individuals or populations associated with construction activities include death of animals unable to avoid construction equipment, temporary displacement of animals within the pipeline ROW, and increased stress on animals during a crucial period of their life cycle. Most of the animals that would be affected are common and abundant in surrounding habitats, have high reproductive potentials and should recolonize the area following reclamation and natural revegetation. In most cases these would be short-term impacts. Loss, displacement, or disturbance of individual animals or populations would not be considered significant except where high interest or federal/state listed and candidate species were affected. Loss of habitat incurred during construction of the proposed pipeline would vary from short-term to long-term depending on the revegetation potential of an area, which is generally inversely related to aridity [Vasek et al., 1975]. Since most of the habitat that would be traversed by the proposed route is widely distributed in the western United States, loss of habitat would not be considered significant except for habitat that has been identified as a critical or high priority requirement for a high interest wildlife species or represents habitat for federal or state listed threatened, endangered or candidate species. In addition, riparian areas generally provide the greatest variety and abundance of wildlife. As such, disturbance to these communities would be considered significant, but are addressed in the vegetation section.

Indirect impacts to wildlife associated with the proposed pipeline construction would be increased use of vehicles and the presence of man in previously remote areas. Increased access could result in continual disturbance of sensitive species and degradation of habitat.

Residual impacts would include low level disturbance associated with the operation of compressor stations and periodic inspections of the pipeline that may result in loss of individuals due to vehicular contact, including aircraft.

The following criteria used to delineate significant impacts to wildlife are based on ecological principles and were derived from state and federal policies and standards, available scientific documentation, the professional judgement of resource specialists.

- Impacts to high interest animals, which include game animals and raptors, were considered significant if pipeline construction activities would disturb these species during high stress periods (i.e. winter, migration, breeding and rearing) or result in a loss of greater than one percent of a local population. Raptors and sage grouse are particularly sensitive during breeding and/or nesting. Disturbance within a half-mile of sage grouse leks or raptor nests would be considered significant if it occurred during breeding and/or nesting periods.

- Impacts to habitat were considered significant if greater than one percent of a discrete unit of critical or high priority habitat of high interest animals would be disturbed by construction activities. These areas include ranges necessary to sustain an animal or population during stress periods (e.g., winter), breeding and rearing grounds, or nest sites.

- Loss of any federal and/or state listed endangered, threatened or candidate species was considered a significant impact. Disturbance that would result in a reduction in recruitment to their populations was considered a significant impact.

- Loss or disturbance of designated critical habitat of listed threatened or endangered species was considered a significant impact. Loss or disturbance of greater than one percent of habitat supporting a viable population of any federal or state listed threatened, endangered, or candidate species and BLM sensitive species was considered a significant impact. In addition, loss of any traditional structure or site considered an essential life history component of these species was considered a significant impact.

Impacts caused by pipeline construction and associated activities are categorized according to significance:

Class I: Significant adverse impacts that could not be mitigated or avoided.

Class II: Significant adverse impacts that could be feasibly mitigated or avoided.

Class III: Adverse but not significant impacts.

Class IV: Beneficial impacts.

Significant impacts to general wildlife are identified in Table 4.2-13. Impacts are listed by species, type of impact, and pipeline location.

Species of special concern included animals listed as threatened or endangered by the federal government or by any of the states traversed by the proposed pipeline. Federal candidate species were also included. Additionally, species identified as sensitive by a state or federal governmental agency were included. The presence of species of special concern along the proposed route is presented in Table 3.1-15 in Section 3.1.7.2. General locations for species of special concern are presented in the Affected Environment and are generally not reiterated in this chapter.

4.2.7.2.1 Kern River Mainline

Wyoming Basin (MP 0-40)

General Wildlife. Within the Wyoming Basin region, disturbance to high interest species would generally be concentrated on the west side of Cumberland Flats from MP 25-35. Crucial pronghorn winter range is traversed by the proposed alignment and disturbance during winter stress periods would be a Class II impact. Loss of habitat would be minimal and a Class III impact. Sage grouse leks, a prairie falcon nest and a golden eagle nest are present within a half mile of the alignment. Disturbance during breeding/nesting would be a Class II impact. One sage grouse lek site occurs along the proposed ROW; loss of this site would be a Class II impact.

Table 4.2-13

SIGNIFICANT WILDLIFE IMPACTS, KERN RIVER PROPOSAL

Wildlife groups and life requisites impacted [1]

Milepost	Wintering [3] big game	Migrating [3] big game	Calving/ [3] fawning big game	Nesting/ breeding sage grouse	Upland [2] game bird critical habitat	Nesting/ brooding waterfowl	Nesting raptors
0-20	-	-	-	x [4]	-	-	-
21-40	P	-	-	x	-	-	2 nests
41-60	MD	-	-	-	-	-	-
61-80	M,E,MD	M,E,MD	-	-	-	-	-
81-100	M,E,MD	MD	-	-	-	-	-
101-120	-	MD	-	-	-	-	-
121-140	E,MD	-	-	-	-	-	-
141-160	MD,E	-	-	x	-	-	4 nests
161-180	MD,E	-	E	-	-	-	1 nest
181-200	E	-	-	-	-	x [4]	1 nest
201-220	MD	-	-	-	-	x	1 nest
221-240	MD,E	-	-	-	CQ	-	2 nests
241-260	-	-	-	-	P	-	-
261-280	MD	-	-	x	-	-	-
281-300	MD	-	-	-	-	-	-
301-320	MD	-	-	x	-	-	-
321-340	-	-	-	x	-	-	-
341-360	MD	-	-	-	-	-	1 nest
361-380	MD	-	MD	-	-	-	-
381-400	MD	-	-	-	-	-	-
401-420	-	-	-	-	GQ	-	-
421-440	-	-	-	-	GQ	-	-

---

[1] Impacts are delineated by species, where possible, and include both habitat and population related impacts unless specifically stated in the table.
[2] Game birds include California quail (CQ) and ring-necked pheasant (P) in Utah and Gambel's quail (GQ) in Nevada.
[3] Big game species include mule deer (MD), elk (E), moose (M) and pronghorn (P).
[4] An "x" signifies that an impact occurs within the milepost designation

Wildlife Species of Special Concern. The proposed pipeline would impinge upon approximately 1,600 acres of identified prairie dog colonies. On-site investigations by BIO/WEST found that approximately 600 acres of these identified colonies are active and potentially provide habitat for black-footed ferrets. If ferrets are present, any construction or operational activities that result in disturbance or loss of individuals would be a Class II impact. Prairie dogs could benefit from the soil disturbance and removal of vegetation, and may occur in higher densities along the ROW after construction. This would be an increase in potential ferret habitat and a Class IV impact. If ferrets became established along the completed route, increased access may result in loss of individuals through crushing by vehicles or shootings. This would be a Class II impact.

Middle Rocky Mountains (MP 40-185)

General Wildlife. Within the Middle Rocky Mountains region, the proposed pipeline ROW would traverse critical elk, deer and moose winter range as well as high priority deer and elk winter range. In addition elk and deer migration routes would be crossed by the pipeline. There would be a significant impact to individuals if construction activities occurred during migration or winter stress periods. This is considered a Class II impact. The potential loss of habitat within three deer, two elk, and one moose critical winter ranges would also be a significant concern and is considered a Class II impact. Disturbance of other big game winter range would be a Class III impact. Raptor nests along the proposed route would be susceptible to disturbance during nesting. Such disturbance would be a Class II impact. Loss of one golden eagle nest site would be a Class II impact. Sage grouse breeding and nesting habitat is present within the Uinta National Forest. Construction disturbance during breeding/ nesting would be a Class II impact. Loss of this habitat would be a Class III impact. The potential loss of waterfowl habitat would be minimal and is considered a Class III impact. If construction occurred during nesting season, a few individuals may be lost. Because of their relative tolerance to disturbance and propensity to renest, impacts to the populations would be limited to a Class III impact.

Wildlife Species of Special Concern. One bald eagle winter roost has been identified in Salt Creek Canyon adjacent to the proposed ROW. Construction activities occurring during winter would be a Class II impact. Loss of this winter roost site would be a Class II impact.

Basin and Range (MP 185-390)

General Wildlife. Within the Basin and Range region, the alignment would not significantly impact big game critical and high priority winter habitat. Impacts to this habitat would be short-term and classified as a Class III impact. Disturbance during winter would significantly impact individuals under the stress of a negative energy balance, a Class II impact. Two sage grouse leks and associated nesting habitat occur within 0.5 mile of the proposed ROW. One lek is present along the proposed ROW, and its loss would be a Class II impact. Disturbance to breeding birds would also be a Class II impact. Important pheasant and California quail habitat would also be traversed. This is some of the highest quality habitat for pheasant and California quail in Utah, and habitat destruction would a Class II impact. Additionally, critical waterfowl nesting habitat would be traversed by the proposed route. Loss of habitat in this vicinity would be a Class II impact. If construction occurs during the nesting season, a few individual birds may be expected to be lost. Because of their relative tolerance to disturbance and propensity to renest, impacts to individual birds would be limited and are considered a Class III impact.

Five golden eagle nests occur along the proposed corridor within this region, and resident birds would be significantly impacted if disturbed during the nesting season. This would be a Class II impact.

Wildlife Species of Special Concern. Approximately three miles of potential desert tortoise habitat (approximately 36 acres) would be crossed by the proposed pipeline in southwestern Utah in the vicinity of Beaver Dam Wash. Construction activities during winter hibernation or daily estivation would result in loss of individuals through crushing or exposure to predators. Active tortoise would also be lost due to crushing by heavy equipment operations or by falling into open trenches and becoming trapped. Assuming a minimal density of 25 tortoise per square mile, at least one tortoise would be lost due to construction activities. Although detailed mitigation measures are available to minimize loss of individuals, it is assumed that they would not be completely successful. Therefore, loss of any individual would be a Class I impact. Because of the poor revegetation potential of the blackbrush scrub community, loss of habitat would be a Class I impact. In addition, the potential for increased access to the federally protected Beaver Dam Slope area may result in loss of individuals and habitat, both of which are Class II impacts.

One large area has been defined by the Utah Division of Wildlife Resources as a bald eagle winter concentration area. Due to the large expanse of this area and lack of roosting sites along the proposed ROW, this would be a Class III impact.

Mojave Desert (MP 390-711)

General Wildlife. The proposed pipeline would cross critical Gambel's quail summer habitat in southern Nevada. Disturbance to individuals would be limited to short-term displacement (Class

III impact). Some mortality could result if disturbance occurred during the summer stress period (Class III impact). Loss of shrub cover and food would be considered significant. Because of the poor revegetation potential of the shrub community, this is considered a Class I impact. The proposed route would traverse six areas of potential raptor nesting. At present no raptor nests have been identified within the area of concern. If active nests are present within 0.5 mile of the proposed ROW, disturbance of nesting raptors would be a Class II impact.

Water guzzlers are a wildlife management tool utilized in arid environments to provide a given area with a water source. Guzzlers tend to concentrate wildlife. Construction activity in the vicinity of guzzlers would likely disturb the wildlife present. Short-term disturbance would not be expected to significantly disrupt use patterns at these sites as long as the guzzlers remained operational during and after project completion. This is a Class III impact.

Wildlife Species of Special Concern. Essential condor habitat would be traversed by the proposed route east of the Tehachapi Mountains. This area is utilized for foraging by condors, and construction activities would be expected to produce a short-term minimal disturbance of animals using the area and would be considered a Class III impact. However, since the three condors remaining in the wild will likely be captured for the captive breeding program prior to pipeline construction, there is little likelihood of any impact to condors [Blum, 1986].

In Nevada, the route would traverse three crucial tortoise habitats for a total of 54 miles. Nevada crucial desert tortoise habitat is designated by having tortoise densities greater than 40 per square mile. In California, the proposed ROW would cross 10 miles of high density habitat (100-250 animals per square mile), 20 miles of moderate density habitat (50-100 per square mile) and 19 miles of low density habitat (20-50 per square mile). Construction and revegetation activities at any time of year would result in loss of individuals from crushing on the surface or inside burrows; loss of cover and increased human activity would increase tortoise susceptibility to predators. Tortoises could also be lost by falling into the open pipeline trench. Assuming an average density of 40 tortoise/sq mi within the Nevada crucial habitats, and the midpoint density figures for the three habitat described densities in California (i.e., $175/mi^2$, $75/mi^2$, $35/mi^2$), and a 100 ft ROW, 116 tortoise would potentially be lost due to construction activities. Although detailed mitigation measures are available to minimize loss of individuals, it is assumed that they would not completely negate all losses. Therefore, loss of individuals would be a Class I impact. Because of the poor revegetation potential of the vegetation communities associated with the desert tortoise, loss of suitable habitat would be a Class I impact. This would include disturbance of 1,246 acres within the habitats defined above, and an additional 2,434 acres of suitable habitat that is not presently identified as high tortoise density habitat. Increased off-road vehicle access to these high density tortoise habitats along the completed ROW would increase vandalism to tortoises and long-term habitat deterioration. These are Class II impacts.

The Gila monster is an uncommon inhabitant of sandy or rocky washes in southern Nevada, and believed to be rare in California. Only one known habitat has been identified within the proposed ROW. Gila monster densities are generally thought to be low throughout their range in Nevada [Turner, 1986] and loss of individuals through pipeline construction activities would significantly affect the viability of local populations. This would be a Class I impact.

The proposed pipeline would traverse suitable habitat of the Mojave ground squirrel. Its distribution is limited to the desert scrub habitat of the western Mojave desert of California, particularly the creosote bush scrub and saltbush scrub communities. The proposed route would cross approximately 70 miles of this habitat. Construction activities would result in the crushing of individuals by construction equipment on the surface and in their burrows. Loss of individuals could be minimized, but not negated and would be a Class I impact. Other individuals may be displaced during construction, but should recolonize the affected area shortly after disturbance is completed. This would be a Class III impact. Because of the poor revegetation potential of the desert scrub communities associated with the Mojave ground squirrel, the loss of approximately 850 acres of suitable habitat would be a Class I impact.

The proposed route would cross four desert bighorn migration routes and would be a Class II impact.

Swainson's hawks potentially nest in Shadow Valley of eastern California. Construction activities within a half mile of an active nest during the nesting season would be a Class II impact.

Tehachapi Mountains (MP 711-746)

General Wildlife. No significant potential impacts to general wildlife have been identified within the Tehachapi Mountains. Temporary disturbance or loss of vegetation would be a Class III impact.

Wildlife Species of Special Concern. California condors range throughout the Tehachapi Mountains. The pipeline would cross critical condor habitat in the vicinity of Tejon Ranch. No nests or roosts have been identified within the vicinity of the proposed corridor. Impacts would be expected to be relegated to short-term disturbance with individual birds reoccupying the affected area immediately after construction is terminated. This would be a Class III impact. Routine aerial inspections of the completed pipeline pose the potential risk of aircraft/condor collisions. Loss of any individuals would be a Class I impact. These aerial inspections could also disturb any condor utilizing the immediate area (Class III impact). However, since the remaining three condors existing in the wild will likely be captured for the captive breeding program prior to proposed construction, no impact to the condor is anticipated [Blum, 1986].

The Tehachapi slender salamander may exist along north-facing slopes within moist canyons and ravines in oak-pine woodlands, and are frequently found under rotting logs and accumulated leaf litter [SCRA et al., 1980]. The proposed pipeline traverses less than one mile of suitable habitat for this species. Construction activities within a viable population would result in the crushing of individuals. Loss of any individuals would be a Class II impact. Because of the limited amount of available suitable habitat, any loss would be a Class II impact.

The Tehachapi pocket mouse may be found on the lower western foothills of the Tehachapi Mountains; the four species of blister beetles also occur in these western foothills. At present it is unknown whether the proposed line would traverse any viable populations, and it must be assumed that an indeterminate number of individuals of each species would be lost due to short-term construction activities. Loss of individuals would be considered a Class II impact.

San Joaquin Valley (MP 746-756.1)

General Wildlife. No significant potential impacts to general wildlife have been identified within the San Joaquin Valley. Temporary disturbance or loss of vegetation would be a Class III impact.

Wildlife Species of Special Concern. The pipeline route would traverse essential condor habitat. Impacts would be the same as discussed under the Kern River mainline.

San Joaquin kit fox habitat would be traversed by the last six miles of pipeline in this region; however, given the lack of recent sightings, this area is considered marginal habitat for kit fox [BLM, 1984b]. If kit fox are present and natal dens occur along the ROW, construction activities when pups are in the dens from February to late April would result in the loss of individuals due to crushing or suffocation in collapsed dens. This would be a Class II impact. Construction activities would also cause a temporary displacement of local individuals, although reoccupation of the affected area would be expected soon after construction is completed. This would be a Class III impact. Natal dens appear to be somewhat traditional, and may represent ancestral breeding sites important to the successful reproduction of the species [BLM, 1984b]. As such, loss of natal den sites would be a Class II impact. No natal dens are known to occur along this segment of the proposed alignment. Loss of this marginal habitat would be a Class III impact.

4.2.7.2.2 Kern River Lateral

General Wildlife. No significant impacts are expected to occur as a result of pipeline construction and operations.

Wildlife Species of Special Concern. The pipeline route would traverse essential condor habitat. Impacts would be the same as discussed under the Kern River mainline.

Approximately five miles of suitable San Joaquin kit fox habitat are present along the proposed route; however the kit fox is not limited to this suitable habitat and may occur anywhere along the route where natural vegetation communities are present. Significant impacts to kit fox are discussed under the Kern River mainline. Loss of less than one percent of suitable habitat would be a Class III impact.

Approximately four miles of blunt-nosed leopard lizard suitable habitat would be traversed by the proposed lateral. Construction would result in the loss of an unknown number of individuals through crushing by construction equipment on the surface and destruction within their burrows. Some individuals may also be lost by falling into open trenches. Loss of individuals could be minimized, but not negated and would be a Class I impact. Habitat loss would be significant if revegetation efforts were to fail and weedy species were introduced which favored other lizard species and thus increased competition [BLM, 1984a]. Loss of approximately 50 acres of habitat would be a Class II impact. Increased access along the completed ROW would result in long-term habitat degradation and the potential loss of individuals through crushing by vehicles. Maintenance operations along the pipeline may also result in crushing of individuals. These are Class II impacts.

Suitable habitat for the Tipton kangaroo rat is limited along the proposed alignment; only 0.5 mile of this alignment would cross known suitable habitat. Construction activities would result in the loss of individuals residing within the ROW. These animals dig shallow burrows in friable soils that are susceptible to collapse from the weight of heavy equipment. They are weak diggers and if trapped in a collapsed burrow would have little chance of escaping. Because they are strictly nocturnal, daytime construction activities would be certain to trap individuals within their burrows. Losses would be minimal because of the limited occurrence of this species along the proposed route; however any loss would be a Class I impact. Clearing of vegetation along the ROW would be a Class IV impact by reducing shrub cover and providing more of the open habitat type preferred by this species.

The San Joaquin pocket mouse and Tehachapi pocket mouse potentially occur within the affected area. At present, it is unknown whether the proposed route would traverse any viable populations, and it must be assumed that an indeterminate number of individuals of each species would be lost due to construction activities. Loss of individuals would be a Class II impact.

4.2.7.2.3 Taft Lateral

General Wildlife. No significant impacts are expected to occur as a result of pipeline construction and operation.

Wildlife Species of Special Concern. The pipeline route would traverse essential condor habitat. Impacts would be the same as previously discussed under the Kern River mainline.

Approximately 24 miles (approximately 290 acres) of blunt-nosed leopard lizard suitable habitat would be traversed by the proposed lateral. Impacts would be the same as previously discussed under the Kern Lateral.

Approximately 24 miles (approximately 290 acres) of San Joaquin kit fox suitable habitat occurs along the proposed route. Four active natal dens and 20 diurnal dens are known to occur within the area of concern. Significant impacts to kit fox are discussed under the Kern River mainline.

The giant kangaroo rat occurs in grassland habitat of the valley floors along the west side of the San Joaquin Valley. Ground surveys identified 40 active colonies in the vicinity of the proposed pipeline between the California Aqueduct and McKittrick. The proposed alignment would cross approximately 15 miles of suitable giant kangaroo habitat (approximately 180 acres).

Because giant kangaroo rats are strictly nocturnal and spend the daytime in shallow burrows, they would be highly susceptible to construction activities that would collapse burrows resulting in the loss of individuals. This would be a Class II impact. Some colonies are concentrated in small areas of suitable habitat, and it is conceivable that local populations could be decimated. Habitat disturbance may have a beneficial impact (Class IV) by removing shrubs creating the open habitat preferred by this species. A permanent ROW would provide additional barren areas that would be used by kangaroo rats for dust baths and loafing.

The short-nosed kangaroo rat ranges from the western foothills east to the California Aqueduct. The proposed route would traverse approximately 24 miles of this range (approximately 290 acres). Ground surveys located two active burrow systems in one small discrete locale along the proposed route. This kangaroo rat digs shallow burrows in friable soils that are susceptible to collapse from the weight of heavy equipment. They are weak diggers and if trapped in a collapsed burrow would have little chance of escaping. Because they are strictly nocturnal, daytime construction activities would be certain to trap individuals within their burrows. Losses would be minimal because of the limited occurrence of this species along the route; however any loss would be a Class I impact. Clearing of vegetation along the ROW would be a Class IV impact by reducing shrub cover and providing more of the open habitat type preferred by this species.

Suitable habitat for the Tipton kangaroo rat is limited along this alignment. Two small discrete locations totaling approximately two miles of this alignment have been described by Williams [1985] as potentially supporting this species. Impacts would be the same as previously discussed under the Kern Lateral.

The proposed route would traverse approximately 24 miles of Nelson's antelope squirrel range from the California Aqueduct north to its terminus near McKittrick. Ground surveys during June-July 1986 recorded 15 squirrels along this segment of the proposed route. Construction activities would disturb this species and there would potentially be a few individuals that would be crushed in their burrows by heavy equipment operations. However, this species is diurnally active and highly mobile, and would, in most cases, be able to avoid construction hazards. Loss of individuals could be minimized, but probably not negated, and would be a Class I impact. Construction disturbance may cause a temporary displacement of individuals, although they are expected to return soon after the construction phase is completed. This would be a Class III impact. Reduction of shrub cover would result in the loss of natural habitat for this species, a Class II impact. However, observations during ground surveys of the proposed route and observations by Williams [1980] indicate that a moderate amount of soil disturbance may actually create improved habitat conditions by providing additional burrow sites. As such, this would be a Class IV impact.

4.2.7.2.4 Compressor Stations

General Wildlife. No significant impacts to general wildlife would occur as a result of construction and operation of three compressor stations along the Kern River mainline. Disturbance and loss of 40-50 acres of vegetation at each site would be a Class III impact.

Wildlife Species of Special Concern. One prairie dog town occurs in the vicinity of Compressor Station No. 1 in the Wyoming Basin Region. If ferrets are present, any construction or operational activities that result in disturbance or loss of individuals would be a Class II impact.

No impacts to species of special concern are expected due to construction and operation of Compressor Station No. 3.

Desert tortoises potentially occur at the proposed site of Compressor Station No. 5. If present, they occur in low densities. Construction activities would result in the loss of individuals present during construction. Because of the limited size of the station, mitigation efforts would be sufficient to eliminate any loss of individuals, and would be considered a Class II impact. Because of the poor revegetation potential of the Mojavean desert vegetation communities associated with the desert tortoise, loss of 45 acres of suitable habitat would be a Class I impact.

4.2.7.2.5 Summary of Significant Impacts

The following section summarizes significant wildlife impacts that have been previously addressed under the separate geographic regions. An abbreviated form is presented in Table 4.2-14.

Table 4.2-14
SUMMARY OF WILDLIFE IMPACTS, KERN RIVER PROPOSAL

Wildlife Class	Impact to [1] Individuals	Impact to Habitat
Game Species [2]	193 miles (II) [3]	146 acres (I) 234 acres (II) 2 grouse leks (II)
Raptors	12 nesting pairs	1 nest (II)
Species of [4] Special Concern Concern	137 miles (I) 27 miles (II)	3760 acres (I) 376 acres (II) 1 bald eagle roost (II) 4 kit fox natal dens (II)

---

[1] Impacts to individuals are quantified by cumulative miles of proposed pipeline where impacts would occur.

[2] Game species include ungulate big game, upland game birds, and waterfowl.

[3] Indicates impact class: I = Significant adverse impact that could not be mitigated or avoided; II= Significant adverse impact that could be feasibly mitigated or avoided.

[4] Species of Special Concern include all federally listed species, candidates for listing, state listed species and BLM sensitive species. Because of the speculative nature of impacts to black-footed ferrets and California condors, they have been excluded from this table.

General Wildlife. Construction activities would significantly disturb game species (pronghorn, mule deer, elk, moose and sage grouse) along approximately 193 miles of the proposed pipeline. Disturbance to these species during critical periods of their life cycle would be a Class II impact.

Twelve raptor nests have been identified within 0.5 mile of the proposed pipeline. The potential exists for other nests along the whole extent of this pipeline. Disturbance during nesting would be a Class II impact. One golden eagle nest may be located along the ROW; loss of this nest site would be a Class II impact.

Disturbance of approximately 146 acres of Gambel's quail habitat would be a Class I impact due to the poor revegetation potential of the Mojavean desert vegetation community. Disturbance of approximately 234 acres of big game, upland game bird and waterfowl critical habitat would be a Class II impact.

Loss of two sage grouse leks and one golden eagle nest that have been identified along the ROW would be a Class II impact.

Wildlife Species of Special Concern. The black-footed ferret and California condor are extremely rare species that potentially occur along the proposed route for 30 and 110 miles respectively. It is unlikely that the proposed pipeline would affect either species; however approximately 600 acres of suitable ferret habitat does exist within 0.5 mile of the proposed route within the Wyoming Basin. If ferrets were present, construction activities would be a Class II impact. Because the three remaining condors in the wild are expected to be captured for the captive breeding program [Blum, 1986], construction would not impact condors. However, if a condor was killed due to operational procedures, it would be a Class I impact.

The proposed pipeline would cross approximately 164 miles of identified habitat for species of special concern. All but seven mile of this identified habitat occurs within the Mojave Desert Region and San Joaquin Valley Region. Construction activities along approximately 137 of these miles would be Class I impacts resulting in the loss of desert tortoise, Gila monsters, blunt-nosed leopard lizards, Mojave ground squirrels, Nelson's antelope squirrels, Tipton kangaroo rats and short-nosed kangaroo rats.

Construction activities along approximately 27 miles of the proposed route would disturb Tehachapi slender salamander habitat, a bald eagle winter roost site, potential Swainson's hawk nesting area, giant kangaroo rat habitat, desert bighorn migration, and San Joaquin kit fox habitat. Disturbance or loss of individuals along these 27 miles would be a Class II impact. In addition there would be an unquantifiable loss of Tehachapi pocket mice, San Joaquin pocket mice, and four species of blister beetles. This would be a Class II impact.

Disturbance of approximately 3,760 acres of desert tortoise and Mojave ground squirrel habitat would be a Class I impact due to the poor revegetation potential of the sites.

Disturbance of an approximate cumulative total of 376 acres of Tehachapi slender salamander, blunt-nosed leopard lizard, Tipton kangaroo rat, and Nelson's antelope squirrel habitat would be a Class II impact.

Loss of one bald eagle winter roost site located within the ROW would be a Class II impact. Four active San Joaquin kit fox dens, and the potential for others, occur within the area of concern. Loss of natal dens would be a Class II impact.

4.2.7.3 Grazing

Potential impacts to grazing were judged significant if lost grazing opportunity would reduce livestock carrying capacity on an allotment traversed by the proposed pipeline. For the purposes of this EIR/EIS, a loss of five percent of the grazing opportunity for an allotment during a short-term (construction phase) or long-term (operational phase) period was considered significant. Because stocking rates for allotments are nearly always based on a forage per acre basis, comparison of the percent of AUMs affected would assess potential impacts to all allotments on an equal basis. The five percent level represents the best estimate of the lowest relative portion of an allotment that could be temporarily (<3 years) lost without requiring permanent reductions in livestock stocking rates.

A significant level of impact for a given allotment could be reached in the following ways:

- Direct ROW disturbance to five percent or more of an allotment.
- Temporary splitting of an allotment by fences erected to allow revegetation or to avoid soil erosion thereby isolating a portion of the allotment greater than five percent or separating livestock from important water sources.
- Elimination of grazing for three to five years on the allotment or pasture affected if building fences were impractical or would create additional impacts.

Assessment of impacts to grazing within the areas of concern included the following assumptions: 1) all of the ROW would be lost to grazing for at least three years while revegetation occurred; 2) livestock containment facilities would not be affected once the proposed action was completed; 3) no new access would occur to the allotments or associated pastures; 4) efforts to revegetate the ROW with native or naturalized species would be reasonably successful during grazing, except in National Forests in Utah; and 5) any loss of grazing on private land would be successfully mitigated between the private land owner and the developer.

These assumptions are based on operating procedures proposed by the developer or standards for operation of federal land management agencies. The USFS and BLM may stipulate specific management actions, such as fencing of the ROW for several years, to assure that revegetation is successful on a case by case, allotment by allotment basis.

Based on the first criteria for significant impacts listed above, no significant impacts to grazing were noted along the route of the Kern River Proposal. However, because of steep terrain, high elevation, a short growing season and the livestock classes utilizing some allotments within the U.S. National Forests in Utah, the potential exists for significant impacts based on the second and third criteria as listed above. Also, some adverse impacts to grazing may occur to several allotments as a result of construction and operation of the proposed project. It is not possible to predict where these potential or minor adverse impacts would occur prior to staking the ROW. Adverse impacts include introduction and spreading of noxious weeds, separation of livestock from developed water sources, changes to normal trailing patterns and loss of forage (< 5 percent).

4.2.8 Socioeconomics

The significance criteria have been discussed in Section 4.2.8 in Volume I.

4.2.8.1 Population, Housing, and Economic Impacts

The proposed pipeline will traverse 18 counties in four states. Three compressor stations will be constructed. Compressor No. 1, at MP 0, will have 17,200 hp and be located in Lincoln County, Wyoming. Compressor No. 3, at MP 267, will have 9,100 hp and be located in Millard County, Utah. Compressor No. 5, at MP 518, will have 9,900 hp and be located in Clark County, Nevada. The project will directly affect 7,600 acres of land during construction and 5,100 acres during operation.

The pipeline will be constructed by nine spreads as follows:

1) 75.08 miles, Lincoln, Uinta Counties, WY, and Summit County, UT
2) 51.5 miles, Summit, Wasatch, and Utah Counties, UT
3) 67 miles, Utah, Juab, and Sanpete Counties, UT
4) 151.9 miles, Millard County, UT
5) 72.1 miles, Iron and Washington Counties, UT
6) 126.3 miles, Lincoln and Clark Counties, NV
7) 128.3 miles, San Bernardino County, CA

8) 101 miles, San Bernardino and Kern Counties, CA
9) 75 miles, Kern County, CA

The impacts of the Kern River project in terms of employment, population, and income are for the most part insignificant. The change in the assessed valuation or tax base of many of the counties in Utah are very significant. This results from the fact that there is very little infrastructure at present in those counties. While a change in tax receipts is generally viewed as positive, careful public finance planning may be required at the local level.

The demands for housing will be a problem with this project. Workers on sections of the project in Utah will not find local housing supply sufficient to meet their demands. This will require the use of workcamps or some other means of enhancing the available housing supply. The demand for housing is not met in Lincoln County, Nevada, although this problem will be rectified by commuting to Clark County in Nevada. Construction workers may, however, wind up spending more locally than predicted in this analysis if they stay in Las Vegas in Clark County. Local demands for rental units and RV spaces will not be met in the Wyoming counties where construction will occur. This will result in a shift in demand to Green River and Rock Springs in nearby Sweetwater County.

Table 4.2-15 presents aggregate socioeconomic impact information for the Kern River Pipeline Project. Kern River Gas Transmission Company provided information on the number of spreads, location of spreads, and size of construction crews [KRGT, 1986]. Estimates of other indicators were based on information provided for the Mojave Pipeline Project. The compressors in this proposed project are assumed to be constructed in the same way as the MJ-1 Compressor Station in the Mojave Pipeline Project. Operation personnel are based on the Mojave Project and are expanded to account equally for the difference in length of the pipelines and the number of compressor stations.

Construction crews required for the nine Kern River spreads and three compressor stations will total 4,536 workers (4,101-spreads, 435 - compressor stations), of which 2,948 or 65 percent will be nonlocal workers and inmigrate (Table 4.2-15). To the extent that these types of skills are present in the local population, there may be a greater amount of hiring of local highly skilled labor. In addition, 328 miscellaneous nonlocal persons will be required, bringing the total of inmigrant workers to 3,276. It is estimated that .3 dependents will accompany each inmigrant worker based on a survey relevant to the Pactex and Celeron pipelines as well. Including the dependents, the total inmigrant population is estimated to be 4,260 for the nine pipeline spreads and three compressors. Employment of local residents will total 1,436 workers for the nine pipeline spreads, or 160 per spread, and 51 for each of three compressor stations. Total local residents expected to be hired onto the project will

Table 4.2-15

AGGREGATE SOCIOECONOMIC IMPACT INFORMATION, KERN RIVER PROPOSAL

									Compressor Stations		
Characteristics	Spread No.1	Spread No.2	Spread No.3	Spread No.4	Spread No.5	Spread No.6	Spread No.7	Spread No.8	Spread No.9	No.1	No.3	No.5
Location	Lincoln/ Uintah,WY Summit,UT	Summit/ Wasatch/ Utah, UT	Utah/Juab/ Sanpete,UT	Juab/Mill./ Beaver,UT	Iron/ Wash.,UT	Lincoln/ Clark,NV	San Ber., CA	San Ber./ Kern,CA	Kern, CA	Linc., WY	Mill., UT	Clark, NV
Length (miles)	75	51.5	67	151.9	72.1	126.3	128.3	101	75	n/a	n/a	n/a
Construction duration (days)	62	121	132	114	99	95	98	80	165	150	150	150
Construction crew	497	431	434	503	429	257	488	486	376	145	145	145
Other personnel required for construction	36	31	31	36	31	33	35	35	27	11	11	11
Local construction personnel	174	151	152	176	150	160	171	170	132	51	51	51
Nonlocal construction personnel	359	311	313	363	310	330	352	351	271	105	105	105
Dependents of nonlocal personnel	108	93	94	109	93	99	106	105	81	32	32	32
Total inmigrant population	466	405	407	472	403	429	458	456	353	137	137	137
Housing demand by inmigrants (units):												
Hotels/Motels	154	134	135	156	133	142	152	151	117	45	45	45
Rental Units	100	87	88	102	87	92	99	98	76	29	29	29
R/V Campers	97	84	85	98	84	89	95	95	73	28	28	28
Other	7	6	6	7	6	7	7	7	5	2	2	2
Local expenditures by nonlocal construction personnel	$1,523,968	$2,579,232	$2,833,293	$2,835,963	$2,100,488	$2,147,176	$2,365,232	$1,922,888	$3,068,312	$1,108,380	1,108,380	1,308,300
Local expenditures by local construction personnel	1,570,281	2,657,615	2,919,296	2,922,148	2,164,322	2,212,428	2,437,111	1,981,325	3,161,558	1,108,380	1,108,380	1,108,380
Local expenditures by contractors	392,095	269,238	350,271	794,123	376,934	660,288	670,744	528,021	392,095	1,476,500	1,476,500	1,476,500

Operation Personnel Total = 121

SOURCES: Kern River Gas Transmission Co. provided information on the number of spreads, location of spreads, and size of construction crews [KRGT, 1986]. Estimates of other indicators were based on information provided for the Mojave Pipeline Project. The compressors in this proposed project are assumed to be constructed in the same way as the Mohave County Compressor Station in the Mojave Pipeline Proposal. Operation personnel are based on the Mojave Proposal and are expanded to account equally for the difference in length of the pipelines and the number of compressor stations.

be 1,589. The local residents will most likely be the lesser skills types such as truck drivers and common laborers. The higher skill categories will be imported into the local region. Examples of these types of construction workers are welders, blasters, powdermen, and foremen. The nonconstruction personnel that will move into the local area are generally company representatives, engineers, and inspectors.

Changes in local area population from inmigrant workers and their families are expected to average 428 per spread and 137 per compressor station (Table 4.2-15). The greatest increases will occur in the San Bernardino and Kern Counties in California, Clark County, Nevada, and Millard County, Utah. In all cases, population increases related to construction will be brief (i.e. a maximum of 165 days or six months) and not exceed the significance criteria.

An estimated 121 persons will be employed in the operation of the pipeline. The expectation is that approximately two-thirds will be based in Bakersfield and the remaining 40 or so persons and their families will be based near the compressor stations. In no case does the population increase associated with these operation personnel and their families pose a significant increase in population in any local area.

Table 4.2-15 presents the expenditures made in the local economies by local and nonlocal personnel with the wages earned as a result of the project. Total expenditures per nonlocal worker per day will be $68.50 and $145.60 per local worker. Expenditures will total $24 million for nonlocal workers and $24.6 million for local workers. Together, expenditures by both local and nonlocal workers will exceed $49.9 million. This amount will be distributed among 18 counties and concentrated where the temporary influx of population will be largest.

In addition to local expenditures by construction workers, the contractors will most likely make some local purchases of goods and services. These will be mostly miscellaneous items such as repair services, fuel, minor tools, water, and rental cars. The total amount of these purchases is expected to be $8.9 million.

The local purchases by workers and contractors will result in increased economic activity in the local regions. Retail stores and various services will benefit. In addition, some tax revenues will be generated in the course of the purchases through sales tax and from income taxes paid on wages earned as a result of the increased local economic activity. The major source of increased local revenues will be the increased property taxes on the additional tax base or assessed valuation created by the pipeline and the three compressor stations. The increases in the local tax bases in nominal terms and as a percent of the existing tax bases are presented in Table 4.2-16. As the table indicates, several of the counties will experience significant economic gains as a result of the pipeline. Two of the more rural

Table 4.2-16

CONTRIBUTION TO COUNTY TAX BASE, KERN RIVER PROPOSAL

State/County	Length of Line (miles) Facilities	Estimated Taxable Value of Pipeline and Facilities (Millions)	Total 1984/1985 County Assessed Value (Millions)	Pipeline Percentage of Total Value	1984/1985 County Tax Revenues (Millions)
CALIFORNIA					
Kern	156	$78.8	$31,451.7	0.25%	$293.3
San Bernardino	144	89.7	30,598.6	0.29	350.8
NEVADA					
Clark	106 Compressor Station	71.7	7,518.2	0.95	139.6
Lincoln	23	18.4	46.4	39.66	1.5
UTAH					
Beaver	37	23.1	34.2	67.40	1.4
Davis	0	0.0	592.0	0.00	8.4
Iron	50	31.2	113.3	27.49	6.4
Juab	43	26.8	44.1	60.75	2.3
Millard	63 Compressor Station	48.2	296.2	16.27	2.1
Morgan	0	0.0	27.2	0.00	1.6
Salt Lake	0	0.0	3,483.4	0.00	246.9
Sanpete	4	2.5	63.7	3.91	0.8
Summit	45	28.0	663.7	4.22	21.1
Utah	37	23.1	842.5	2.74	50.3
Wasatch	26	16.2	57.4	28.22	3.1
Washington	48	29.9	180.5	16.57	8.8
WYOMING					
Lincoln	17 Compressor Station	27.5	297.1	9.25	20.3
Uinta	38	23.7	945.5	2.50	61.0

SOURCE: Value of pipeline and facilities are based on preliminary and capital cost estimates for the Mojave Pipeline Project [Gulf Interstate Engineering, 1985]. Mainline costs were used for all segments with the exception of the Kern County laterals. Compressor Station costs were from the same source and computed on a per horsepower basis. Local tax and value information was obtained from the California State Board of Equalization, Utah State Auditor's Office, Clark County Nevada Comptroller, and the Wyoming County Treasurers' Office.

Table 4.2-17
HOUSING DEMAND DISTRIBUTION BY AFFECTED AREA, KERN RIVER PROPOSAL

	Temporary Housing									
	Hotel/Motel Rooms			Rental Units			RV Spaces			
State/County*/City	Supply	Demand	%	Supply	Demand	%	Supply	Demand	%	Permanent Housing
CALIFORNIA										
Kern	495*	41	8	4,478			289*	88	30	6,591
Bakersfield	2,758	227	8	975	174	18	264	80	30	1,435
San Bernardino	12*	1	8	9,933			253*	42	17	19,833
Barstow	1350	186	14	94	107	114	238	47	20	187
Needles	580	80	14	29	33	112	440	86	20	59
Victorville	688	36	5	133	57	43	203	15	7	266
NEVADA										
Clark	1,375*	6	0	8,247			154*	7	4	12,187
Henderson	625	3	0	458	18	4	0	0	**	677
Las Vegas	53,600	178	0	2,577	103	4	2,675	110	4	3,807
Lincoln	0	142	**	84	92	110	12	89	742	105
UTAH										
Beaver	0	156	**	30	102	340	365	98	27	50
Davis	0	0	**	450	0	0	460	0	0	1,131
Iron	0	0	**	128			0	0	**	243
Cedar City	400	133	33	42	87	208	163	84	52	79
Juab	0	291	**	66	190	288	0	183	**	104
Millard	0	201	**	46	131	285	53	126	238	100
Morgan	0	0	**	4	0	0	0	0	**	16
Salt Lake				5,343						9,429
Salt Lake City	10,000	0	0	2,241	0	0	641	0	0	3,956
Sanpete	0	135	**	89	88	99	140	85	61	177
Summit	0	188	**	322	187	58	199	181	91	427
Utah				1,310			92*	27	29	2,606
Orem	20	2	10	307	73	24	0	0	**	612
Provo	2,040	167	8	424	102	24	484	142	29	843
Wasatch				50			145*	41	28	90
Heber City	200	134	67	19	87	448	155	43	28	35
Washington				185			134*	64	19	475
St. George	2,000	133	7	82	87	106	107	20	19	211
Weber				1,236						1,926
Ogden	1,000	0	0	788	0	0	148	0	0	1,228
Box Elder				154						259
Brigham City	150	0	0	28	0	0	75	0	0	105
Cache										
Logan	540	0	0	0	0	25	0	0	0	0
WYOMING										
Lincoln	74*	53	72	133			8*	13	163	167
Kemmerer	204	146	72	43	129	300	72	112	156	54
Uinta	96*	11	11	139			0	0	**	163
Evanston	1,255	143	11	66	100	153	22	97	441	77
Sweetwater				388			192*	0	0	538
Green River	165	0	0	100	0	0	55	0	0	138
Rock Springs	1,249	0	0	188	0	0	140	0	0	261

* Additional rooms and RV spaces in the county near the ROW. ** Infinite percentage resulting from division by zero.
SOURCES: Hotel/Motel supply derived from Affected Environment sections. Rental Units supply is calculated as those units for rent. Year round supply is calculated as those units for rent or sale. Units listed as vacant awaiting occupancy or demolition, held for occasional use, or boarded up were not included. Due to a lack of data on rental unit or year round unit available housing supply for individual cities, the relationship between the numbers of these types of units and total housing units in the county in which the city exists was used to adjust total vacant units in each individual city.

counties in Utah will experience increases of 60 percent or greater. Counties affected in such a way will have the opportunity to significantly expand public services or decrease taxes paid by local residents.

The distribution of temporary housing demand by accommodation type is based on the following distribution: Hotel/Motels - 43 percent; Rental Units - 28 percent; R/V Campers - 27 percent; and Other - 2 percent, based on data reported for the Mojave and Transwestern projects which were also found to be relevant to the Pactex and Celeron projects. The demands for temporary accommodations are distributed to various cities in the study region in Table 4.2-17. The distribution is based on both the available supply of temporary housing and the distance to the construction site. Demands for permanent housing for the operations personnel are assigned to the city where the operation office or facilities will most likely be. This methodology was discussed in detail in Section 4.2.8 in Volume I.

In several cases, the demands for housing will be substantial relative to supply, especially where the number of available accommodations is low. The applicant has indicated that temporary labor camps will be built to alleviate this problem and hence, shortages are not anticipated given that commitment. The shortages in housing supply relative to demand will be particularly severe in the Utah counties. The proximity of Salt Lake City (10 miles to the Wasatch Variation and 40 miles to the mainline), Ogden (38 miles to the ROW), and Brigham City (50 miles to the ROW), to the counties in which the construction will be occurring will result in a significant absorption of the excess demand in the rural areas. However, an augmentation to supply will be required in Beaver, Davis, Juab, and Millard Counties.

Housing shortages will also occur in Kemmerer and Evanston. The likely response will be longer commuting distances to Green River and Rock Springs which have adequate housing supplies. Shortfalls in the supply of rental units in Barstow and Victorville in San Bernardino County, California, will most likely result in a shift in demand to motel rooms which are in adequate supply there. Excess demand for housing in predominantly rural Lincoln County in Nevada will result in a shift in demand to Las Vegas in adjacent Clark County. Accommodations are extensive in the Las Vegas area.

4.2.8.2 Traffic

Significance criteria have been discussed in Section 4.2.8.2 in Volume I.

There may be some traffic delays when construction equipment and workers' vehicles are near U.S. Highway 93/95 and I-15 in Clark County, Nevada, where traffic volumes are high.

4.2.8.3 Noise

Pipeline construction would cause a temporary impact on noise quality. The specific noise levels would depend on the equipment involved; the impact would depend on the location of the potential receptors. Typical noise levels for construction would range from 70 to 105 dBA at 50 feet depending on the equipment. Typical noise levels attributable to a construction spread are about 70 dBA at 250 feet from the pipeline and 50 dBA at 2,500 feet. Any receptor adjacent to the ROW would be affected only while a spread was working in the area.

At selected locations along the proposed ROW, controlled blasting would be required to fracture hard rock formations. This would elevate sound levels temporarily. Blasting would be conducted during daylight hours to reduce possible disturbance.

Since construction activities would be of a temporary nature and no sensitive noise receptors are located along the construction route, construction noise is not considered a significant impact. There are no state regulations governing noise emissions during construction or operation of the proposed project.

Construction of the three proposed compressor stations would take about six months each. During this time noise levels would vary with the type of activity and the actual equipment being used. Only Compressor Station No. 5 could adversely affect noise levels; however, the noise reaching the nearby receptor would be attenuated by distance and topography.

The three proposed compressor stations would be the major source of noise emissions during the pipeline operation. The applicant has conducted a baseline noise monitoring survey at Northwest's Muddy Creek Compressor Station, the site of Kern River Compressor Station No. 1. The Kern River compressor is site rated at 18,200 hp. The Muddy Creek Compressor Station is site rated at 3,730 hp. Operational noise levels within the plant boundaries ranged from 59 to 94 dBA. Readings at the property boundaries ranged from 45 to 68 dBA. The nearest noise sensitive area was a ranch house located approximately five miles northwest of the Muddy Creek Compressor Station. The sound level at the ranch was 40 dBA.

The applicant is assuming that Solar Mars turbine/compressor units would be utilized at the three proposed compressor stations. Each unit would be equipped with the following noise abatement equipment: (a) standard self cleaning barrier type air cleaner; (b) standard one meter inlet silencer, and (c) standard two meter exhaust silencer.

Solar Turbines Incorporated has provided field sound pressure level data for full load operation with decibel levels ranging from 79 to 82 dBA at 50 feet and 49 to 52 dBA at 500 feet.

Calculated noise levels associated with full-load operation of the proposed compressor stations for the nearest noise sensitive areas would be 27.5 dBA for Compressor Station No. 1, 18.5 dBA for Compressor Station No.3, and 40.5 dBA for Compressor Station No. 5.

Because the resultant sound levels at any nearby noise-sensitive area would be well below 55 dBA, the level identified by EPA as protecting the public from outdoor activity interference and annoyance, the Kern River compressor station noise levels would not represent a significant impact.

4.2.8.4 Recreational Resources

For a general discussion of impacts on developed facilities and dispersed recreation opportunities, please see the introductory paragraphs in Section 4.2.8.4 in Volume I. The Forest Service Recreation Opportunity Spectrum objectives for Forest lands would be compromised where categories move toward the urban side of the range. Providing access to off-road vehicles into Semiprimitive Nonmotorized areas where controls are difficult would constitute a compromise of Forest Service objectives and thus be a significant long-term adverse impact.

Although the mainline route does not actually enter the Wasatch-Cache National Forest, there may be competition for space in the developed campgrounds four miles east of the corridor, especially if the construction takes place between May and October. The same conflict may occur within the Uinta National Forest, especially at Palmyra and Diamond campgrounds near MP 139 and at Strawberry Recreation Area near MP 125. Competition may be minimal, however, because of the excess of supply over demand for motel rooms and RV spaces in the communities in the valleys to the west. Other temporary impacts would include inconvenience of access, increased noise levels, and more dust.

There would be short-term nonsignificant impacts on dispersed recreation opportunities due to the increased levels of noise, and disturbance to fishermen, hikers, photographers, and other who seek a remote quiet setting. Where off-road vehicle access cannot be controlled in Forest Service lands classified as Semi-primitive Nonmotorized, there would be a long-term significant impact. In the Uinta NF, 10 miles of this land would be compromised, specifically between MPs 127-131, 138-142, and 144-146.

There would be short-term impacts on the Clark County Wetlands Park in Nevada during the construction period in the form of increased traffic and noise.

In Kern County, the proposed mainline passes within one half mile of the Kern County Park in Boron. The park's northern boundary is within 1,000 feet and its southern boundary is less than 300 feet of the proposed route. A dirt road and existing pipelines are immediately south of the proposed route. The park is 10 acres in size with 3.8 acres in grass. There are barbecue pits, picnic tables, a sheltered picnic area, restrooms, a recreation building, tennis courts, a concession stand, baseball and soft ball diamonds, and drinking fountains [Coyle, 1986].

The Pacific Crest National Scenic Trail, also in Kern County, may experience temporary disturbance during construction in the form of interruption or delay of traffic as it detours around construction activities, disturbance of vegetation and soils, and disruption of the natural visual scene. The open trench may create a temporary safety hazard. Except for the change in the visual scene, these would be short-term impacts.

4.2.9 Land Ownership/Use

Land use impact assessment for the proposed actions, alternatives, and variations will be addressed in two separate ways. Existing land uses can be impacted on a short- or long-term basis. Short-term impacts consist of actions that will only exist from commencement of the construction to no more than one year. Long-term impacts have the potential to affect the existing land use for more than one year and up to as long as the life of the project (approximately 40 years).

The second way of assessing impats is to examine the policies and regulations of various governmental entities. These policies and regulations will be assessed as a significant impact if the proposed route is not in conformance or compliance with these documents. Existing and planned land uses are controlled by these regulations and policies.

For example, residential areas will be impacted for a short term by construction but there is a potential long-term impact if the route takes residential land out of use for the life of the project. There is a potential for significant impact if the area is zoned for residential use with large-scale utility rights-of-way being excluded. The terms long-term and significant are thus not interchangeable.

Table 4.2-18 shows the number of acres that would be disturbed by each action, alternative, and variation by land ownership category.

Table 4.2-19 shows the number of acres that would be disturbed by each action, alternative, and variation by land use category.

Long-term impacts will occur in any area traversed where the land is used for orchards, vineyards, or forests because the land will be removed from production for the life of the project.

Table 4.2-18

CONSTRUCTION AND OPERATION DISTURBANCE BY LAND OWNERSHIP, KERN RIVER PROPOSAL

County, State	Disturbance Area	Total Acres	Private Acres	BLM Acres	State Acres	FS Acres	DOD Acres
WYOMING							
Lincoln	100' Construction	156.4	75.2	73.9	7.4	-	-
	50' Operation	78.2	37.6	37.0	3.6	-	-
Uinta	100' Construction	600.0	426.7	144.2	29.0	-	-
	50' Operation	300.0	213.3	72.1	14.5	-	-
UTAH							
Summit	100' Construction	441.2	441.4	-	-	-	-
	50' Operation	220.6	220.6	-	-	-	-
Wasatch	100' Construction	305.5	192.7	-	-	112.7	-
	50' Operation	152.7	96.4	-	-	56.4	-
Utah	100' Construction	466.7	231.5	-	12.1	223.0	-
	50' Operation	233.3	115.8	-	6.1	111.5	-
Sanpete	100' Construction	69.1	57.0	-	12.1	-	-
	50' Operation	34.5	28.5	-	6.1	-	-
Juab	100' Construction	545.5	458.2	78.8	8.5	-	-
	50' Operation	272.7	229.1	39.4	4.2	-	-
Millard	100' Construction	781.8	537.0	217.0	27.8	-	-
	50' Operation	390.9	268.5	108.5	13.9	-	-
Beaver	100' Construction	409.7	71.5	318.8	19.4	-	-
	50' Operation	204.8	35.8	159.4	9.7	-	-
Iron	100' Construction	591.5	289.7	252.1	44.8	4.8	-
	50' Operation	295.8	144.8	126.1	22.4	2.4	-
Washington	100' Construction	585.5	36.4	303.0	32.7	213.3	-
	50' Operation	292.7	18.2	151.5	16.4	106.7	-
NEVADA							
Lincoln	100' Construction	278.8	-	278.8	-	-	-
	50' Operation	139.4	-	139.4	-	-	-
Clark	100' Construction	1309.1	206.1	1103.0	-	-	-
	50' Operation	654.5	103.0	551.5	-	-	-
CALIFORNIA							
San Bernardino	100' Construction	1641.2	400.0	1212.1	17.0	-	12.1
	50' Operation	820.6	200.0	606.1	8.5	-	6.1
Kern	100' Construction	983.0	962.4	20.6	-	-	-
	50' Operation	491.5	481.2	10.3	-	-	-
TOTAL MAINLINE WITHOUT LATERALS	100' Construction	9164.8	4385.5	4002.4	210.9	553.9	12.1
	50' Operation	4582.4	2192.7	2001.2	105.5	277.0	6.1
Taft Lateral	100' Construction	581.8	520.0	24.2	-	-	37.5
Kern, CA	50' Operation	290.9	260.0	12.1	-	-	18.8
Kern River Lateral	100' Construction	327.3	327.3	-	-	-	-
Kern, CA	50' Operation	163.6	163.6	-	-	-	-
TOTAL WITH LATERALS	100' Construction	10073.9	5232.7	4026.7	210.9	553.9	49.7
	50' Operation	5037.0	2616.4	2013.3	105.5	277.0	24.8

Table 4.2-19. CONSTRUCTION AND OPERATION BY LAND USE, KERN RIVER PROPOSAL

County, State	Disturbance Area	Total Acres	Grazing/ Rangeland Acres	Timber/ Forest Acres	Irrigated Non-Irrigated/ Agriculture Acres	Residential Acres	Other Acres
WYOMING							
Lincoln	100' Construction	156.4	156.4	-	-	-	-
	50' Operation	78.2	78.2	-	-	-	-
Uinta	100' Construction	600.0	600.0	-	-	-	-
	50' Operation	300.0	300.0	-	-	-	-
Summit	100' Construction	441.2	404.8	-	36.4	-	-
	50' Operation	220.6	202.4	-	18.2	-	-
Wasatch	100' Construction	305.5	192.7	112.7	-	-	-
	50' Operation	152.7	96.4	56.4	-	-	-
UTAH							
Utah	100' Construction	466.7	231.5	235.2	-	-	-
	50' Operation	233.3	115.8	117.6	-	-	-
Sanpete	100' Construction	69.1	69.1	-	-	-	-
	50' Operation	34.5	3.45	-	-	-	-
Juab	100' Construction	545.5	369.7	-	175.8	-	-
	50' Operation	272.7	184.8	-	87.9	-	-
Millard	100' Construction	781.8	721.2	-	60.6	-	-
	50' Operation	390.9	360.6	-	30.3	-	-
Beaver	100' Construction	409.7	380.6	-	29.1	-	-
	50' Operation	204.8	190.3	-	14.5	-	-
Iron	100' Construction	591.5	591.5	-	-	-	-
	50' Operation	295.8	295.8	-	-	-	-
Washington	100' Construction	585.5	372.1	213.3	-	-	-
	50' Operation	292.7	186.0	106.7	-	-	-
NEVADA							
Lincoln	100' Construction	278.8	278.8	-	-	-	-
	50' Operation	139.4	139.4	-	-	-	-
Clark	100' Construction	1309.1	921.2	-	12.1	230.3	145.5
	50' Operation	654.5	460.6	-	6.1	115.1	72.7
CALIFORNIA							
San Bernardino	100' Construction	1641.2	1580.6	-	24.2	36.4	-
	50' Operation	820.6	790.3	-	12.1	18.2	-
Kern	100' Construction	983.0	631.5	-	278.8	72.7	-
	50' Operation	491.5	315.8	-	139.4	36.4	-
MAINLINE WITHOUT LATERALS	100' Construction	9164.8	7501.8	561.2	617.0	339.4	145.5
	50' Operation	4582.4	3750.9	280.6	308.5	169.7	72.7
Taft Lateral	100' Construction	581.8	284.8	-	260.6	-	-
Kern, CA	50' Operation	290.9	142.4	-	130.3	-	-
Kern River Lateral	100' Construction	327.3	145.5	-	109.1	72.7	-
Kern, CA	50' Operation	163.6	72.7	-	54.5	36.4	-
TOTAL WITH LATERALS	100' Construction	10073.9	7932.1	561.2	986.7	412.1	181.8
	50' Operation	5037.0	3966.1	280.6	493.3	206.1	90.9

4.2.9.1 Kern River Mainline

The impacts expected from the construction and operation of the Kern River Mainline are where the pipeline is proposed to cross the Uinta National Forest; this represents a significant impact because the proposed route is not in conformance with the plan to locate within existing utility corridors. Refer to Appendix F for a detailed discussion of Forest Plans. Similar significant impacts occur to the BLM resource areas of House Range, Warm Springs, and Cedar-Beaver-Garfield-Antimony. There would also be a significant impact to the Sunrise Mountain Wilderness Study Area because of the BLM's policy to not allow pipelines to traverse WSAs. The route would traverse the Rainbow Gardens Natural Area; this would constitute a significant effect because it is against BLM policy. The proposed alignment will bisect the Clark County Advanced Wastewater Treatment Plant, and specifically will cross a planned full-scale compost facility. This is a significant impact. The proposed mainline is not in compliance with the Clark County Wetlands Park Master Plan; this constitutes a significant impact. It would also significantly impact the cities of East Las Vegas and Henderson by noncompliance with land use plans and the potential for short- and long-term impact on existing uses. El Tejon Ranch has a stated policy of not allowing pipelines to traverse the ranch. Kern River proposes to pass through the residential community of Stallion Springs within an existing utility corridor; therefore, there is no expected impact.

4.2.9.2 Kern River Lateral

The Kern River Lateral has no expected land use impacts.

4.2.9.3 Taft Lateral

The Taft Lateral has no expected land use impacts.

4.2.10 Cultural Resources

4.2.10.1 Archaeology

Direct and Indirect Impacts. Both direct and indirect impacts will be considered. Direct impacts involve the possibility of direct physical damage or disturbance due to surface or subsurface construction activities. The construction ROW for the pipeline is 100 feet wide, but in view of the lack of precision regarding the exact pipeline route, a 200-foot wide impact zone was utilized for direct impacts. This zone is centered on the proposed pipeline centerline.

Indirect impacts may be caused by straying construction equipment, post-construction erosion, or site vandalism by workers or the public during and after construction. The indirect impact zone chosen for this analysis lies between 100 and 500 feet from the proposed pipeline centerline.

Impact Significance. All impacts to significant sites, whether direct or indirect, are considered to be potentially significant impacts. As noted in Section 3.1.10.1, all sites are considered to be potentially significant except those officially determined to be ineligible for the National Register or those which have been destroyed. Impacts are designated as "potential" because pipeline routes have not been staked on the ground and formally surveyed to determine which sites will in fact be directly or indirectly impacted. Some sites in the direct impact zone may ultimately not be directly impacted. Many of the sites within the zone of indirect impact may prove to be sufficiently inaccessible and/or unlikely to be affected by erosion such that they would not be indirectly impacted. Such determinations can only be made during an on-the-ground survey.

It should be stressed that the impact figures provided below represent impacts to known sites. In most instances, only a small percentage of the pipeline route has been surveyed. In all cases, the percentage of the direct impact zone that has been surveyed has been provided to place impact figures in the proper perspective.

Presence of Very High or High Sensitivity Pipeline Segments. As described in Section 3.1.10.1, 25-mile segments have been rated in terms of their sensitivity for cultural resources. These ratings indicate the sensitivity of these segments in terms of the potential impact they may have on significant cultural resources. As noted earlier, it is only this pipeline segment sensitivity which can serve as an adequate basis for the comparative analysis of routes and variations. In that analysis (see Volume III) the number of very high or high sensitivity segments form the basis for comparison. When such segments are present, this will be indicated.

4.2.10.1.1 Kern River Mainline

Wyoming. Fourteen known cultural resource sites are situated within the zone of direct impact. These include two campsites, a tipi ring and associated lithics, five lithic scatters (one with a hearth), two habitation sites with hearths, a cairn site, an historic Union Pacific Railroad grade, and a historic site of unknown type. One of the lithic scatters and the two habitation sites with hearths have been determined ineligible for the National Register. Finally, there is the California Emigrant Trail which crosses the pipeline. It would qualify for National Register status if the trail has integrity at that point. Only 6.4 percent of the direct impact zone has been surveyed.

Thirty-five known sites are located in the zone of indirect impact. These include two tipi ring sites, 10 lithic scatters, six hearth sites (three with lithics), three campsites, eight habitation sites with hearths and a quarry site. They also include an historic milling site and four historic sites of unknown type. Fourteen of the above sites have been determined ineligible for the National Register, including four lithic scatters, eight habitation sites with hearths, the historic milling site, and one of the historic sites of unknown type.

Utah. Twenty-nine known cultural resource sites are located in the zone of direct impact. These include 19 lithic scatters (three with ceramics and/or groundstone), two historic trash scatters, three quarry sites, and a rockshelter. They also include the Jefferson Hunt Historical Monument, a historic habitation site, two ranch sites (one with prehistoric debris), and a site of unknown type. Finally, this pipeline segment traverses the Mountain Meadows Historic Site area which is listed on the National Register. Only 2.6 percent of the direct impact zone has been surveyed.

A total of 38 sites fall within the zone of indirect impact. These include an historic trail, road, and bridge, a quarry site, three rockshelters (including two with petroglyphs), 25 lithic scatters, and four ceramic scatters. One of the lithic scatters is located in the Mountain Meadows Historic Site area or district. In addition, the historic cemetery of Hamblin has been nominated to the National Register.

Nevada. Five sites lie in the direct impact zone. They include a rockshelter, a ceramic scatter, a lithic scatter, a roasting pit in association with a midden and shelter, and a historic telephone line. Only 10 percent of the direct impact zone has been surveyed.

Eight sites fall within the zone of indirect impact. They include a rockshelter, a stone circle, two lithic scatters, three isolated finds, and a historic dump.

California. A total of 28 sites are located in the zone of direct impact. These include three bedrock mortar or milling features, three quarry sites, a trail, two rockshelter sites (including one with petroglyphs and a grinding feature), a cairn associated with a lithic scatter, 15 lithic scatters (including several camps and one with groundstone), two isolated finds, and a historic railroad bed and associated trash. The site with the cairn and lithics (SBr-1386) is listed on the National Register. One of the large lithic scatters (Ker-322) has been determined to be eligible for the National Register. Only 5.3 percent of the direct impact zone has been surveyed.

Twenty-two sites are situated in the zone of indirect impact. These include five bedrock mortar or milling features, two quarry sites, a rockshelter site with hearth, and 14 lithic scatters, including one with fire altered rock.

The Entire Mainline. A total of 76 sites are located in the zone of direct impact. This includes one prehistoric site and one historic site which are listed on the National Register and a third site (the California Emigrant Trail) which may qualify for National Register status if it has integrity in the analysis corridor. It also includes a prehistoric site which has been determined to be eligible for the National Register and three sites which have been determined ineligible. Note, however, that only 4.9 percent of the direct impact zone has been previously surveyed.

A total of 103 sites are situated in the zone of indirect impact, including a historic site that has been nominated to the eligible National Register. It also includes 14 sites that have been determined ineligible for the register.

There are two very high sensitivity pipeline segments, one in Wyoming and one in Utah. There are six high sensitivity segments: two in utah, one in Nevada, and three in California.

4.2.10.1.2 Kern River Lateral

No known sites are located in either the direct or indirect impact zones. Note, however, that no survey has been done along the pipeline route. There is one high sensitivity pipeline segment along this route.

4.2.10.1.3 Taft Lateral

A historic homestead is located in the direct impact zone. [Note, however, that only 9.2 percent of the direct impact zone has been previously surveyed.] A single lithic scatter is located in the indirect zone of impact.

4.2.10.1.4 Compressor Stations and Microwave Stations

There are no known sites situated within the areas designated for these stations.

4.2.10.2 American Indian Concerns

There is concern by various Indian groups regarding the passage of the Kern mainline through the traditional ethnographic use areas discussed in Section 3.1.10.2. The mainline also passes through the traditional ethnographic use areas of other American Indian groups in the southern San Joaquin Valley, the Tehachapis, and the Mojave Desert in California. There are no known site specific impacts to American Indian heritage values in either the direct or indirect impact zone other than the ancestral (archaeological) sites listed in the previous section.

4.2.11 Paleontological Resources

Paleontological resources in the various proposed pipeline corridors, compressor stations, and microwave stations will be subject to a variety of adverse impacts accompanying construction of the project. These impacts will be in addition to those that have resulted from earlier construction in parallel or nearby rights-of-way. Adverse impacts to fossils, paleontologic localities, and fossiliferous and potentially fossil-bearing rocks are divided into two major categories: direct and indirect.

Direct impacts to paleontological resources are ground-disturbing activities that mainly occur within the 100-foot construction zone, but may also occur outside the construction zone within the one-mile-wide corridor (e.g., access roads). Direct impacts will arise primarily from trenching for the pipeline, grading for staging areas and roads, excavation of rock and dirt for fill, and other surface-breaking activities. Direct disturbances to bedrock usually end with construction; therefore, no ground-disturbing activities are expected to occur during the actual operation of the pipeline. However, the burial of previously exposed rock during construction will be permanent and will prevent future study of these rocks. In addition, exposure of bedrock during construction, or spraying of herbicides to retard plant growth, may subject the rocks to increased weathering and erosion, with the resulting future loss of fossils.

Indirect impacts are those occurr within the one mile-wide corridor but outside the 100-foot construction zone and do not greatly disturb fossil-bearing or potentially fossiliferous rocks. Indirect adverse impacts result in the loss, misuse, or destruction of paleontological resources, and can occur before, during, and after construction. Unauthorized collecting of fossils by project personnel, as well as amateur and commercial collectors, results in increased attrition. Four-wheel drive and other off-road vehicles, when driven over paleontologic localities or fossiliferous rocks during and after project construction, can destroy fossils in the process. Fossils can also be subject to vandalism, especially at rich sites. These indirect impacts are an important consideration because the project corridors are commonly near urban centers and because greater access will be afforded by the building of new access roads, thus increasing visitation to fossiliferous areas.

The relative significance of impacts in a particular area of exposure within a corridor is determined by the paleontological sensitivities of corridor segments and the presence of paleontologic localities. However, without detailed local and regional studies of each area of the various proposed pipeline corridors, it would be very difficult to make an exact determination of the amount of exposure of a rock unit within a corridor. Each corridor segment has only one paleontologic sensitivity rating (high, moderate, low, or undetermined), which is based on the geologic unit(s) with highest paleontologic importance contained within the segment.

Adverse impacts are divided into three ratings: significant, insignificant, and undetermined significance. These ratings are based on the paleontologic sensitivities of segments of the corridors. The translation from impact rating to paleontologic sensitivities and localities is as follows:

Impact Rating		Paleontologic Sensitivity and Locality
Significant	=	High sensitivity, and all localities
Insignificant	=	Moderate and Low sensitivities
Undetermined Significance	=	Undetermined sensitivities

Thus, corridor segments of high paleontologic sensitivity, and all paleontologic localities (regardless of the sensitivity of the surrounding segment) contain significant paleontologic resources that will be subject to significant direct and indirect adverse impacts. Segments of moderate or low sensitivity have insignificant paleontologic resources that will experience insignificant direct and indirect adverse impacts. Finally, segments of undetermined sensitivity contain paleontologic resources of undetermined significance that will be subject to undetermined direct and indirect adverse impacts.

The proposed mainline route would traverse 478.1 miles of formation determined to be significant, 9.6 miles of formation with an undetermined significance and 268.4 miles of formation determined not significant. The proposed Kern River Lateral would traverse 7.2 miles of formation determined significant and 19.8 miles of formation determined not significant. The proposed Taft Lateral would traverse 19.5 miles of paleontological formations determined significant and 28.5 miles of formation determined not significant.

A detailed breakdown of the geological formation, the fossils present, and the milepost locations of the formations have been discussed in the Paleontological Resources Technical Report [Morales, et al. 1987].

4.2.12 Visual Resources

The methodology for discussing the significance of visual impacts upon the existing environment with the development of each pipeline alternative included a three-step process:

1. Identify and evaluate candidate sites from those listed in the existing conditions according to Forest Service (FS) and BLM visual impact criteria. FS and BLM visual impact criteria were used to generate visual classes in an overlay technique that combines the maps of Scenic Quality, Sensitivity Levels, and Distance Zones (where available).
2. Utilize existing FS and BLM maps and overlays to quantify the amount of visual Class P, R, and PR designated FS land, and Class I, II, and IIIa designated BLM land in the candidate site. Lower designated visual classes were omitted for lack of significant visual sensitivity.
3. Summarize visual impact data and assign impact rating values to quantify a cumulative visual impact rating for each pipeline proposal.

Significant or not significant visual impacts are determined according to the identified management class and critical viewpoints. All high and moderate visual impacts are significant; all low visual impacts are not significant.

The visual impact criteria used to evaluate the areas identified under the existing conditions relate comparable FS and BLM visual impact criteria and assigned them a high, moderate, or low impact rating, as shown in Table 4.2-20. The visual impact ratings for pipeline segments in areas of existing modifications, such as utility and pipeline corridors and ROWs, were rated at one level of impact below the designated visual sensitivity as shown in Table 4.2-21. In areas where BLM-designated lands were rated at Class III, but with no accompanying scenic quality information (A, B, or C), the impacts were evaluated at the impact rating of a IIIA classification or the worst case scenario.

Table 4.2-20

VISUAL IMPACT CRITERIA, KERN RIVER PROPOSAL

FS	BLM	Impact Rating
Lands Without Previous Modifications		
P	Class I	High
R	Class II	High
PR	Class IIIA	Moderate
M	Class IV	Low
REH	Class V	Low
Lands With Previous Modifications (Utility and Pipeline Corridors and ROWs)		
P	Class I	Moderate
R	Class II	Moderate
PR	Class IIIA	Low

Table 4.2-21

SUMMARY OF VISUAL IMPACTS, KERN RIVER PROPOSAL

Milepost	Jurisdiction	Affected Resource	VRM/VQO	Critical Viewpoint	Visual Impacts (Miles)			
					High 1/	Moderate 1/	Low	Vac
48.0-53.0	BLM	Bear River Valley	Class II	Hwy. 150 & Evanston	5.0	-	-	-
112.5-112.9	FS	Uinta Natl. Forest	PR	Lake Creek Rd.	0.4	-	-	M
112.9-113.4	FS	Uinta Natl. Forest	R	Lake Creek Rd.	0.5	-	-	M&H
113.4-118.5	FS	Uinta Natl. Forest	PR	Strawberry River Rd.	5.1	-	-	L,M&H
122.2-123.1	FS	Uinta Natl. Forest	R	Highway 40	0.9	-	-	M
123.1-125.4	FS	Uinta Natl. Forest	PR	Highway 40	2.3	-	-	M
131.5-132.0	FS	Uinta Natl. Forest	PR	Seldomseen	0.5	-	-	M
132.0-132.9	FS	Uinta Natl. Forest	R	Seldom seen	0.9	-	-	M
132.9-133.0	FS	Uinta Natl. Forest	PR	Seldom seen	0.1	-	-	M
133.5-133.6	FS	Uinta Natl. Forest	PR	Jeep trails	0.1	-	-	M
141.6-142.2	FS	Uinta Natl. Forest	PR	Diamond Fork Rd.	0.6	-	-	M&H
142.2-142.6	FS	Uinta Natl. Forest	R	Palmyra Cmpgrd./acc.rd.	0.4	-	-	M
142.6-144.3	FS	Uinta Natl. Forest	PR	Palmyra Cmpgrd./acc.rd.	1.7	-	-	L&M
145.2-145.6	FS	Uinta Natl. Forest	PR	Jeep Trails/Diamond Fk.	0.4	-	-	M
145.6-146.0	FS	Uinta Natl. Forest	R	Jeep Trails/Diamond Fk.	0.4	-	-	L&M
220.0-223.0	BLM	Scipio Pass	Class II	Interstate 15	-	3.0	-	-
260.0-270.0	BLM	Baker Canyon	Class IV	Seldom Seen	-	-	10.0	-
275.0-280.0	BLM	Pinnacle Pass	Class III	Black Rock Rd.	-	5.0	-	-
370.0-374.0	FS	Dixie Natl. Forest	PR	Hwy. 18 & Central	-	4.0	-	-
488.0-493.6	BLM	Rainbow Gardens	Class II	Hwy. 93 & 95	5.6	-	-	-
493.6-494.3	BLM	Clark Co. Wetlands	N/A	Visitor Center, trails	0.7	-	-	-
541.5-550.0	BLM	Keany Pass	Class IIA	Interstate 15	8.5	-	-	-
550.0-555.0	BLM	Shadow Valley	Class IIB	Seldom Seen	5.0	-	-	-
638.0-641.0	BLM	Mud Hills	Class IIB	Hwy 395	3.0	-	-	-
			TOTAL (Miles) OF VISUAL IMPACT		42.1	12.0	10.0	

1/ Significant Impacts. The Uinta National Forest has determined that approximately 13 miles of the mainline location on the National Forest would not maintain the established VQO.

The visual impact criteria for each candidate site/area are summarized in the following tables and text by pipeline alternative and milepost designation. In the table the information is organized in the following categories: Jurisdiction (Private Land, FS, or BLM); Affected Resource; VRM/VQO Classification; Critical Viewpoint (roads, towns, campgrounds, or seldom seen); High, Moderate, or Low Visual Impacts (in miles) or No Visual Impact; and Visual Absorption Capacity (VAC) (high, moderate, low).

All pipeline routes, whether additions to existing pipelines or new work, would have limited construction-related visual impacts which include earthwork and grading scars, heavy equipment tracks, support machinery and tool temporary storage, and related waste materials and tailings.

The duration of visual impacts are further defined as short- or long-term vegetation recovery rates. Short-term recovery rates refer to the time period following actual construction of up to five years where the native vegetation has been re-established and the pipeline scars are concealed. Long-term recovery rates refer to impacts on the landscape which require five or more years to regenerate and blend with the surrounding native environment. Specific factors responsible for scarring and long-term visual impacts can include clear cutting during construction, loss of topsoil during construction, slow vegetation rejuvenation rates, short growing seasons, soil erosion and slippage, steep terrain, and an arid climate.

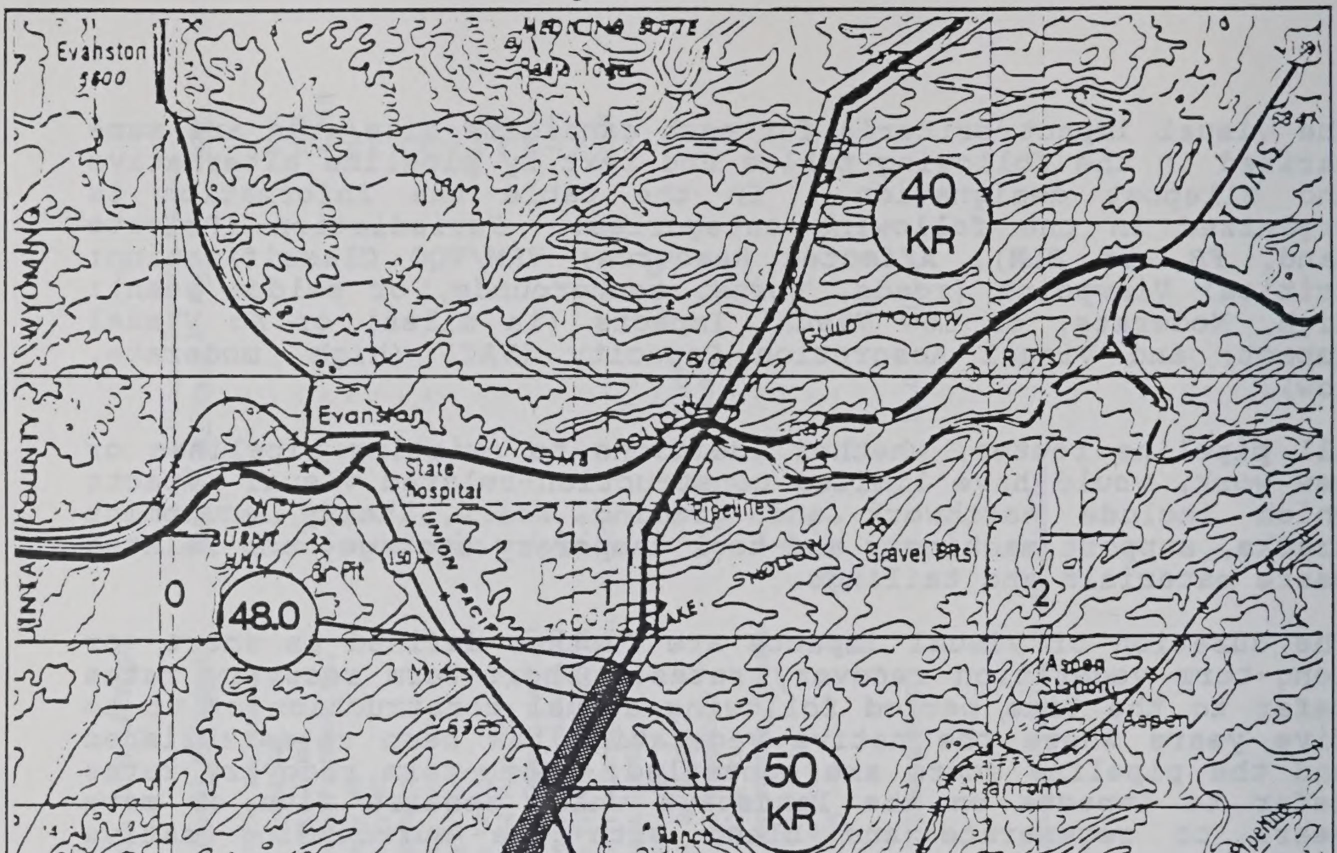
4.2.12.1 Kern River Mainline

MP 48-53, VRM/VQO: BLM Class II
This segment of the route through Bear Valley, Wyoming, would create a high visual impact. The proposed route crosses the Bear River and would be visible to both motorists on Highway 150 and residents from Evanston. The proposed project would result in a long-term vegetation recovery rate. These impacts are significant (Figure 4.2-1).

MP 112.5-112.9, VQO/VQO: FS Class PR
This segment of the route through the Uinta National Forest would create a high visual impact. The pipeline would be seen from critical viewpoints along the Lake Creek-Currant Creek Road. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-2).

MP 112.9-113.4, VRM/VQO: FS Class R
This segment of the route through the Uinta National Forest would create a high visual impact as it climbs a ridge below Bald Knoll. The pipeline would be seen from critical viewpoints along the Lake Creek-Currant Creek Road. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-2).

Figure 4.2-1


MEDICINE BUTTE
Radio Tower
Evanston
6800
WYOMING
UINTA COUNTY
40
KR
TOMS
GUILD HOLLOW
7600
Y R Trs
Evanston
DUNCOMB HOLLOW
State
Hospital
Pipelines
BURNT
HILL
Gr Pit
150
UNION PACIFIC
Gravel Pits
LAKE
2
0
48.0
7000
Mills
6325
Aspen
Station
Aspen
50
KR
Altamont
Ranch
Pipeline
Radio Tower
7000
53.0
19
Spillway
7165
7530
ROCK CUT
7308
60
KR
7398

LEGEND

■ PROPOSED COMPRESSOR STATION

PROPOSED PIPELINE

PROPOSED ALTERNATIVE PIPELINE

120 KR PIPELINE MILEAGE (INTERVAL: 10 MILES)

120.5 IMPACT MILEAGE

▨ HIGH IMPACT

▥ MODERATE IMPACT

⁙ LOW IMPACT

MOJAVE · KERN RIVER · EL DORADO
NATURAL GAS PIPELINE PROJECTS

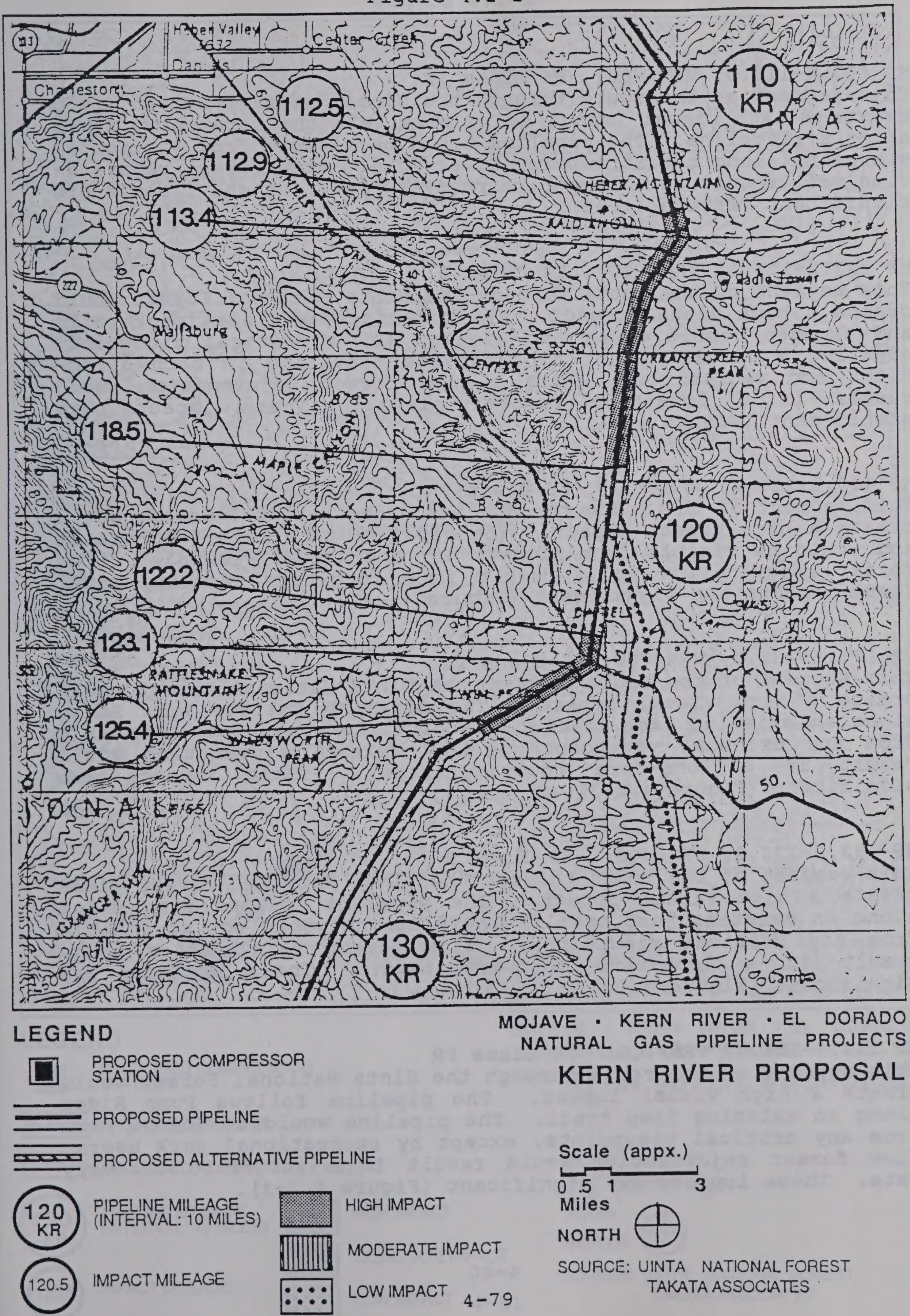
KERN RIVER PROPOSAL

NORTH

Scale (appx.)
0 .5 1 3
Miles

SOURCE: BUREAU OF LAND MANAGEMENT
TAKATA ASSOCIATES

Figure 4.2-2


Heber Valley
Center Creek
Daniels
Charleston
Wallsburg
110 KR
112.5
112.9
113.4
HEBER MOUNTAIN
BALD KNOLL
Radio Tower
CURRANT CREEK PEAK
CENTER
118.5
MAPLE C.
120 KR
122.2
123.1
RATTLESNAKE MOUNTAIN
TWIN PEAKS
125.4
WADSWORTH PEAK
130 KR
NATIONAL
FOREST
50.
LEGEND
PROPOSED COMPRESSOR STATION
PROPOSED PIPELINE
PROPOSED ALTERNATIVE PIPELINE
120 KR PIPELINE MILEAGE (INTERVAL: 10 MILES)
120.5 IMPACT MILEAGE
HIGH IMPACT
MODERATE IMPACT
LOW IMPACT
Scale (appx.)
0 .5 1 3
Miles
NORTH

MOJAVE · KERN RIVER · EL DORADO
NATURAL GAS PIPELINE PROJECTS

KERN RIVER PROPOSAL

SOURCE: UINTA NATIONAL FOREST
TAKATA ASSOCIATES

MP 113.4-118.5, VRM/VQO: FS Class PR
This segment of the route through the Uinta National Forest would create a high visual impact as it parallels the Strawberry River along a ridgeline. The pipeline would be visible from a critical viewpoint along the Strawberry River Road. Slow forest rejuvenation will result in a long-term recovery rate. These impacts are significant (Figure 4.2-2).

MP 122.2-123.1, VRM/VQO: FS Class R
This segment of the route through the Uinta National Forest would create a high visual impact. The pipeline parallels jeep trails and crosses Hobble Creek and Highway 40, a critical viewpoint, creating a visual impact to motorists traveling in both directions and recreational users. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-2).

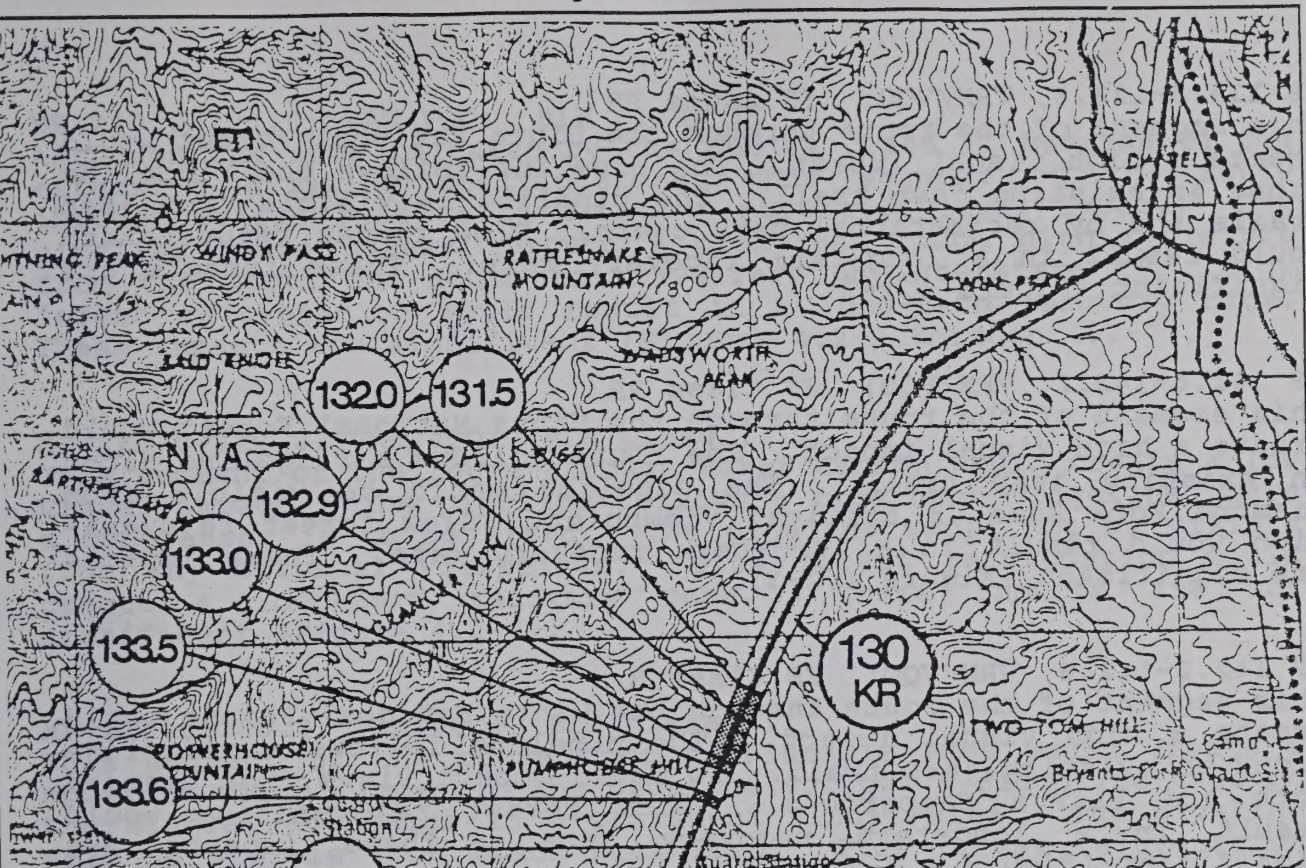
MP 123.1-125.4, VRM/VQO: FS Class PR
This segment of the route through the Uinta National Forest would create a high visual impact. The pipeline parallels jeep trails and would be visible from Highway 40, a critical viewpoint. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-2).

MP 131.5-132.0, VRM/VQO: FS Class PR
This segment of the route through the Uinta National Forest would create a high visual impact. The pipeline follows Pump Ridge along an existing jeep trail. The pipeline would not be visible from any critical viewpoints. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-3).

MP 132.0-132.9, VRM/VQO: FS Class R
This segment of the route through the Uinta National Forest would create a high visual impact. The pipeline follows Pump Ridge along an existing jeep trail. The pipeline would not be visible from any critical viewpoints. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-3).

MP 132.9-133.0, VRM/VQO: FS Class PR
This segment of the route through the Uinta National Forest would create a high visual impact. The pipeline follows Pump Ridge along an existing jeep trail. The pipeline would seldom be seen from any critical viewpoints, except by recreational park users. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-3).

Figure 4.2-3


WINDY PASS
RATTLESNAKE MOUNTAIN
8000
TWIN PEAKS
BALD KNOLL
WADSWORTH PEAK
132.0
131.5
NATIONAL
132.9
133.0
133.5
130 KR
TWO TOM HILL
POWERHOUSE MOUNTAIN
PUMPHOUSE HILL
133.6
Guard Station
Guard Station
142.2
142.6
144.3
145.2
145.6
146.0
WANRHODES CANYON
SPANISH FORK PEAK
NORTH YATES RIDGE
9355
Ford
140 KR
141.6
FORE
8567
TEAT MOUNTAIN
6000

LEGEND

■ PROPOSED COMPRESSOR STATION

PROPOSED PIPELINE

PROPOSED ALTERNATIVE PIPELINE

(120 KR) PIPELINE MILEAGE (INTERVAL: 10 MILES)

(120.5) IMPACT MILEAGE

▨ HIGH IMPACT

▥ MODERATE IMPACT

⁘ LOW IMPACT

MOJAVE · KERN RIVER · EL DORADO
NATURAL GAS PIPELINE PROJECTS

KERN RIVER PROPOSAL

Scale (appx.)
0 .5 1 3
Miles

NORTH

SOURCE: UINTA NATIONAL FOREST
TAKATA ASSOCIATES

MP 133.5-133.6, VRM/VQO: FS Class PR
This segment of the route through the Uinta National Forest would create a high visual impact. The pipeline follows the ridgeline along an existing jeep trail. The pipeline is visible from jeep trails and by recreational park users. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-3).

MP 141.6-142.2, VRM/VQO: FS Class PR
This segment of the route through the Uinta National Forest would create a high visual impact. The route follows a ridgeline along an existing jeep trail. The pipeline would be visible from Diamond Fork Road, a critical viewpoint. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-3).

MP 142.2-142.6, VRM/VQO: FS Class R
This segment of the route through the Uinta National Forest would create a high visual impact. The pipeline follows a ridgeline along an existing jeep trail. It would impact views from Diamond Fork and Palmya Campground. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-3).

MP 142.6-144.3, VRM/VQO: FS Class PR
This segment of the proposed route through the Uinta National Forest would create a high visual impact. The route follows a ridgeline along an existing jeep trail. It would impact views from Diamond Fork Road, Diamond Fork, and Palmya Campground. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-3).

MP 145.2-145.6, VRM/VQO: FS Class PR
This segment of the proposed route through the Uinta National Forest would create a high visual impact. The proposed route follows a ridgeline and would critically impact views from Diamond Fork, campground access roads, and jeep trails. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-3).

MP 145.6-146.0, VRM/VQO: FS Class R
This segment of the proposed route through the Uinta National Forest would create a high visual impact. The proposed route follows a ridgeline and would critically impact views from Diamond Fork, campground access roads, and jeep trails. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-3).

MP 220.0-223.0, VRM/VQO: BLM Class II
Although the area is rated by the BLM as Class II because of the extensive existing modifications, this segment of the route through Scipio Pass would create a moderate visual impact. The pipeline route passes through a prominent ridge highly visible from the north and south to travellers on Interstate 15. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figures 4.2-3 through 4.2-7).

MP 260.0-270.0, VRM/VQO: BLM Class IV
This segment of the route through Baker Canyon would create a low visual impact. The pipeline follows a prominent ridgeline where a compressor is to be sited. The pipeline would not be visible from any critical viewpoints. Slow forest rejuvenation would create a long-term recovery rate. These impacts are not significant (Figure 4.2-8).

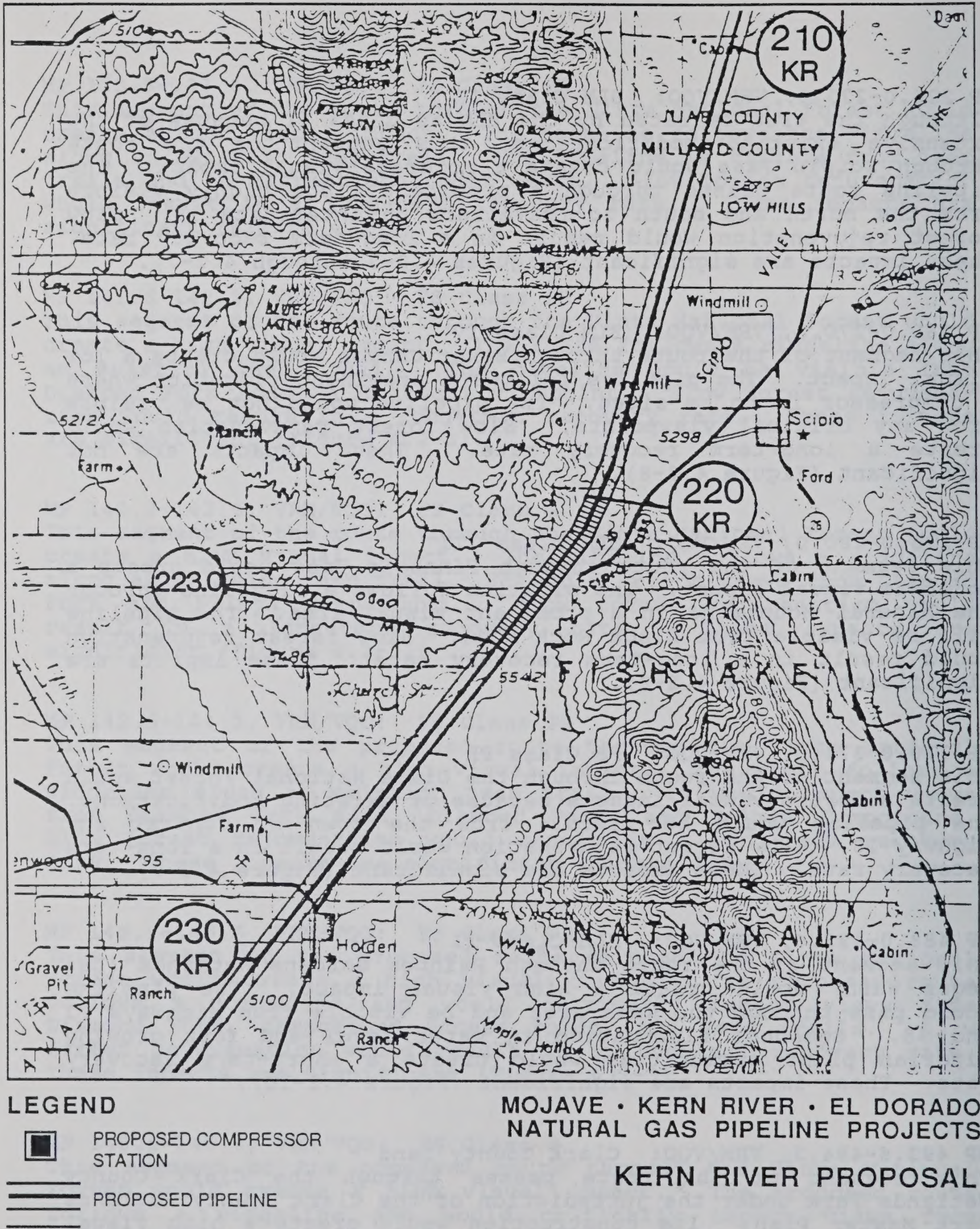
MP 275.0-280.0, VRM/VQO: BLM Class III
This segment of the route through Pinnacle Pass would create a moderate visual impact. The pipeline follows a ridgeline through the Mineral Mountains in a prominent visual area. The pipeline will be visible from Black Rock Road. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-8).

MP 370.0-374.0, VRM/VQO: FS Class PR
This segment of the route through the Dixie National Forest would create moderate visual impacts because of existing modifications. The pipeline would be visible from the town of Central and Highway 18. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-9).

MP 488.0-493.6, VRM/VQO: BLM Class II
This segment of the route through Rainbow Gardens Wetlands (Las Vegas Wash) would create a high visual impact. The pipeline would pass through the wash area and be visible from Highways 93 and 95. Seasonal fluctuation in water level and fast growing riparian plant communities would create a short-term recovery rate. These impacts are significant (Figure 4.2-10).

MP 493.6-494.3, VRM/VQO: Clark County Land
This segment of the route passes through the Clark County Wetlands Park under the jurisdiction of the Clark County Wetlands Park Master Plan. Its construction would create a high visual impact. The pipeline enters the Wetlands Park from Rainbow Gardens, within an area designated in the Master Plan as an important viewshed. The partially exposed pipeline in the wetland corridor would be highly visible from the study shelter and orientation/information center, and to park users (both

Figure 4.2-4


Dam
5104
210
KR
JUAB COUNTY
MILLARD COUNTY
5279
LOW HILLS
VALLEY
Windmill
Scipio
FOREST
5212
Ranch
Farm
Windmill
5298
Scipio
Ford
220
KR
223.0
5000
Cabin
5486
Church
5542
FISHLAKE
Windmill
10
Farm
Cabin
4795
230
KR
Holden
Gravel Pit
Ranch
5100
NATIONAL
Cabin
Ranch
Maple Hollow

LEGEND

■ PROPOSED COMPRESSOR STATION

═ PROPOSED PIPELINE

▤ PROPOSED ALTERNATIVE PIPELINE

(120 KR) PIPELINE MILEAGE (INTERVAL: 10 MILES)

(120.5) IMPACT MILEAGE

▒ HIGH IMPACT

▥ MODERATE IMPACT

⁞ LOW IMPACT

MOJAVE · KERN RIVER · EL DORADO
NATURAL GAS PIPELINE PROJECTS

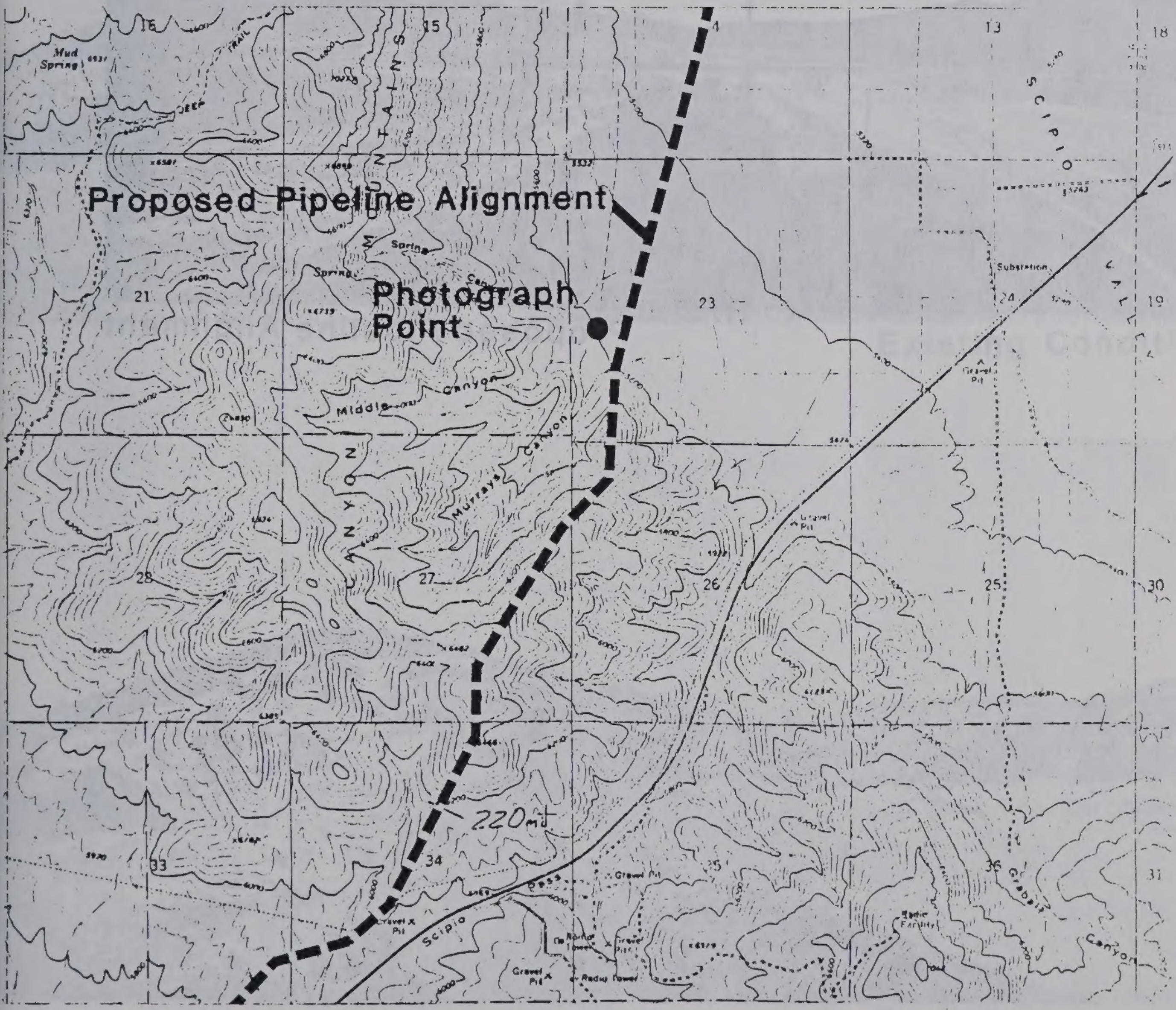
KERN RIVER PROPOSAL

NORTH ⊕

Scale (appx.)
0 .5 1 3
Miles

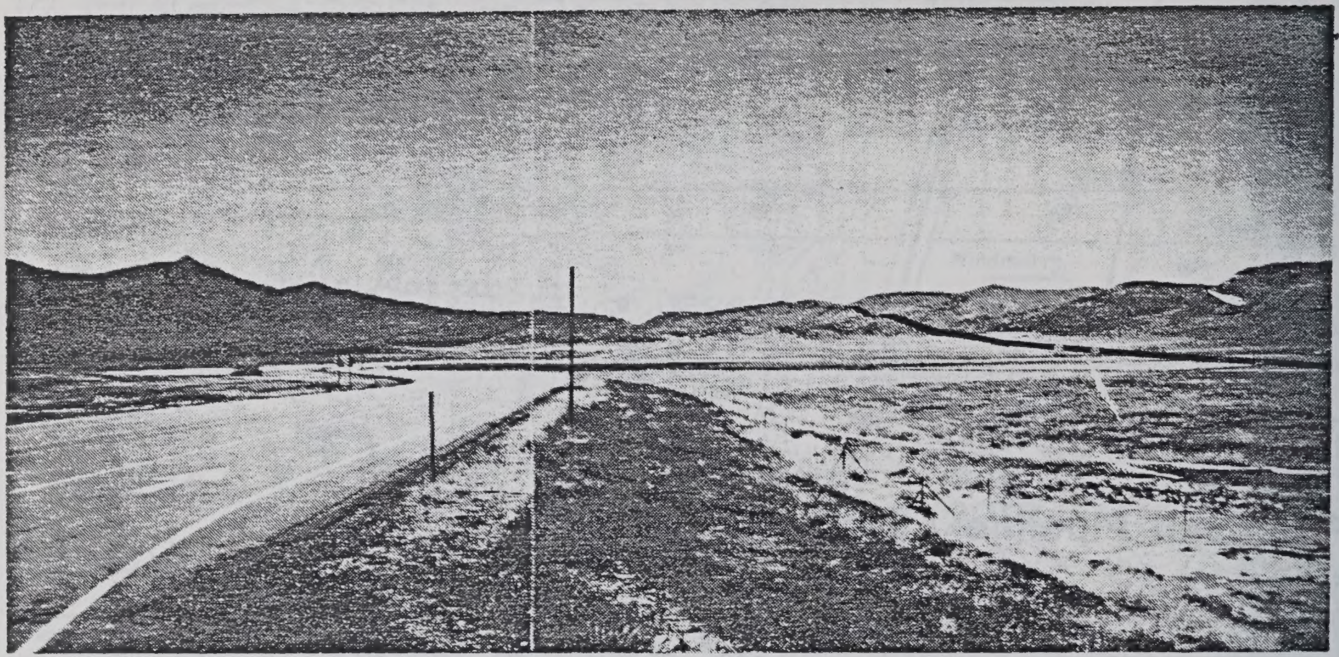
SOURCE: CHAMBERS GRP./SCOPING MTG.
TAKATA ASSOCIATES

Figure 4.2-5


Proposed Pipeline Alignment
Photograph Point
220mi
Mud Spring
Middle Canyon
Murrays Canyon
Scipio Pass
Scipio Valley
Canyon Mountains
Substation
Gravel Pit
Radio Tower
Radio Facility
Gravel Canyon

KERN RIVER PROPOSAL
SCIPIO PASS

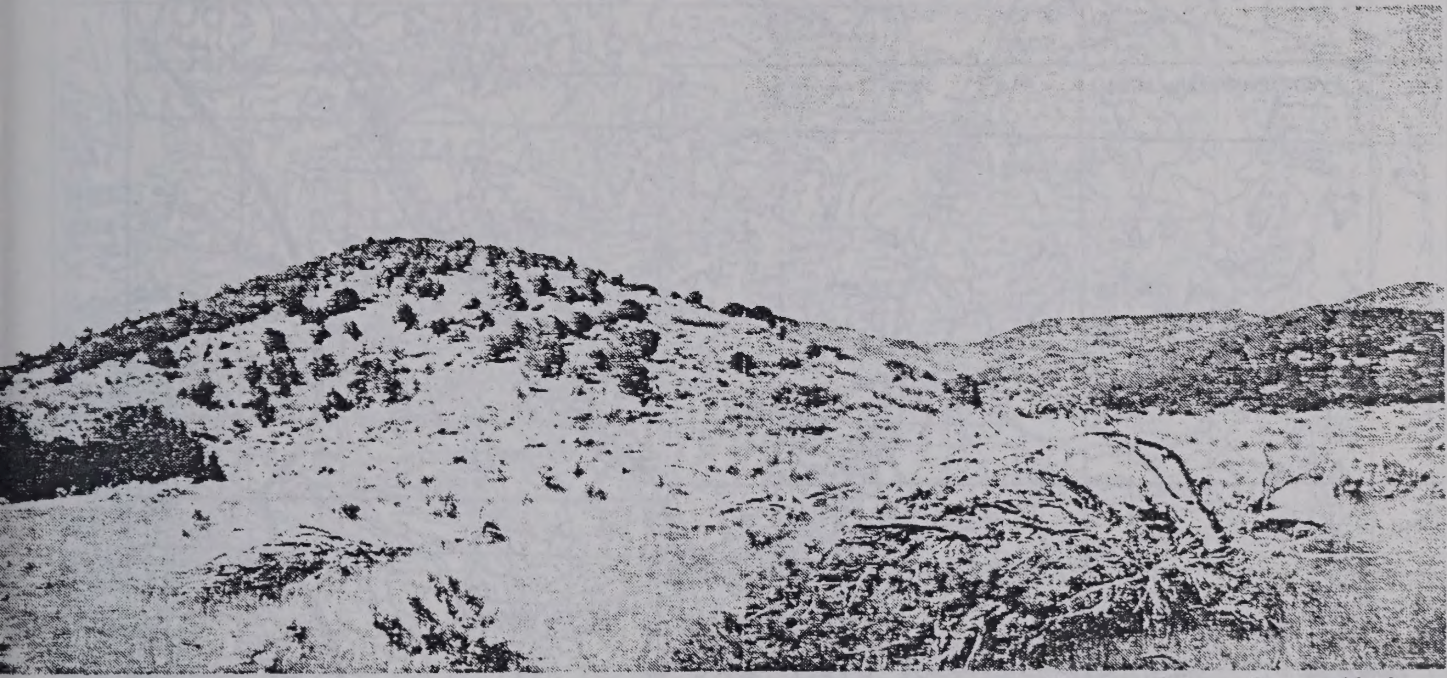
Figure 4.2-6



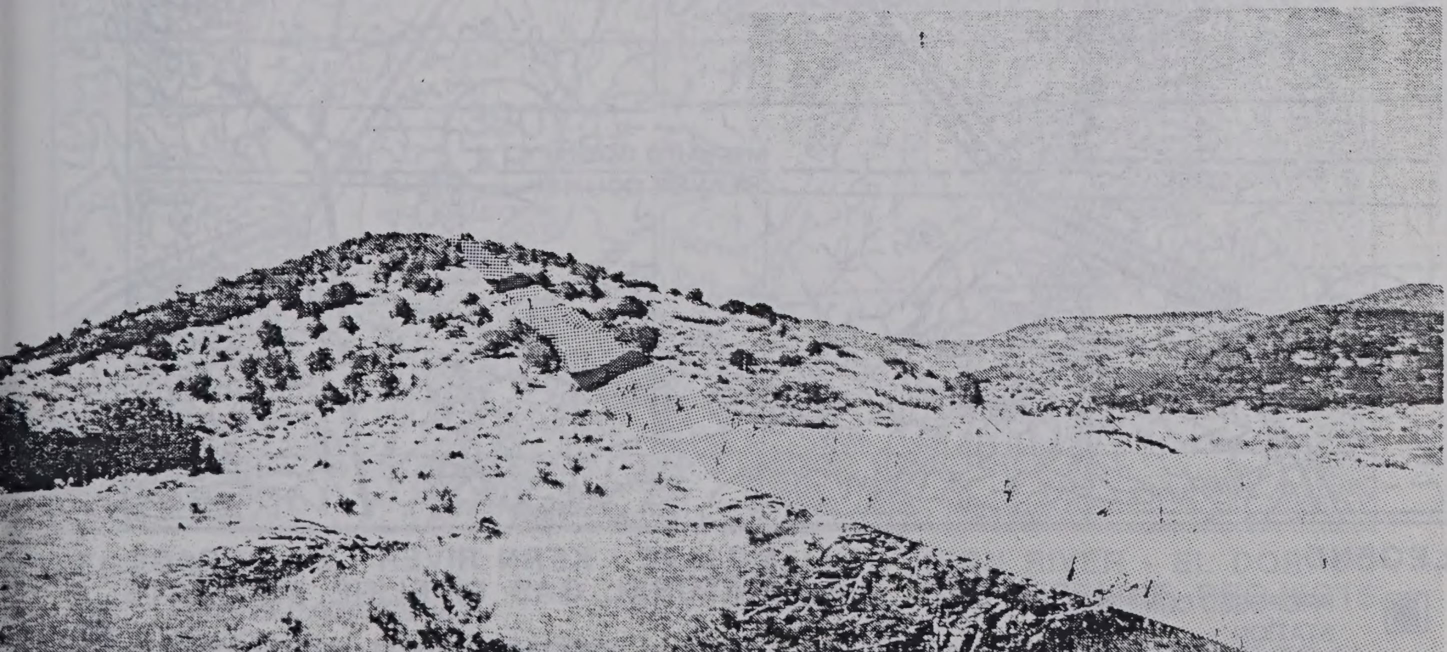
Proposed Pipeline Alignment

KERN RIVER PROPOSAL
SCIPIO PASS
Visual Simulation

Figure 4.2-7



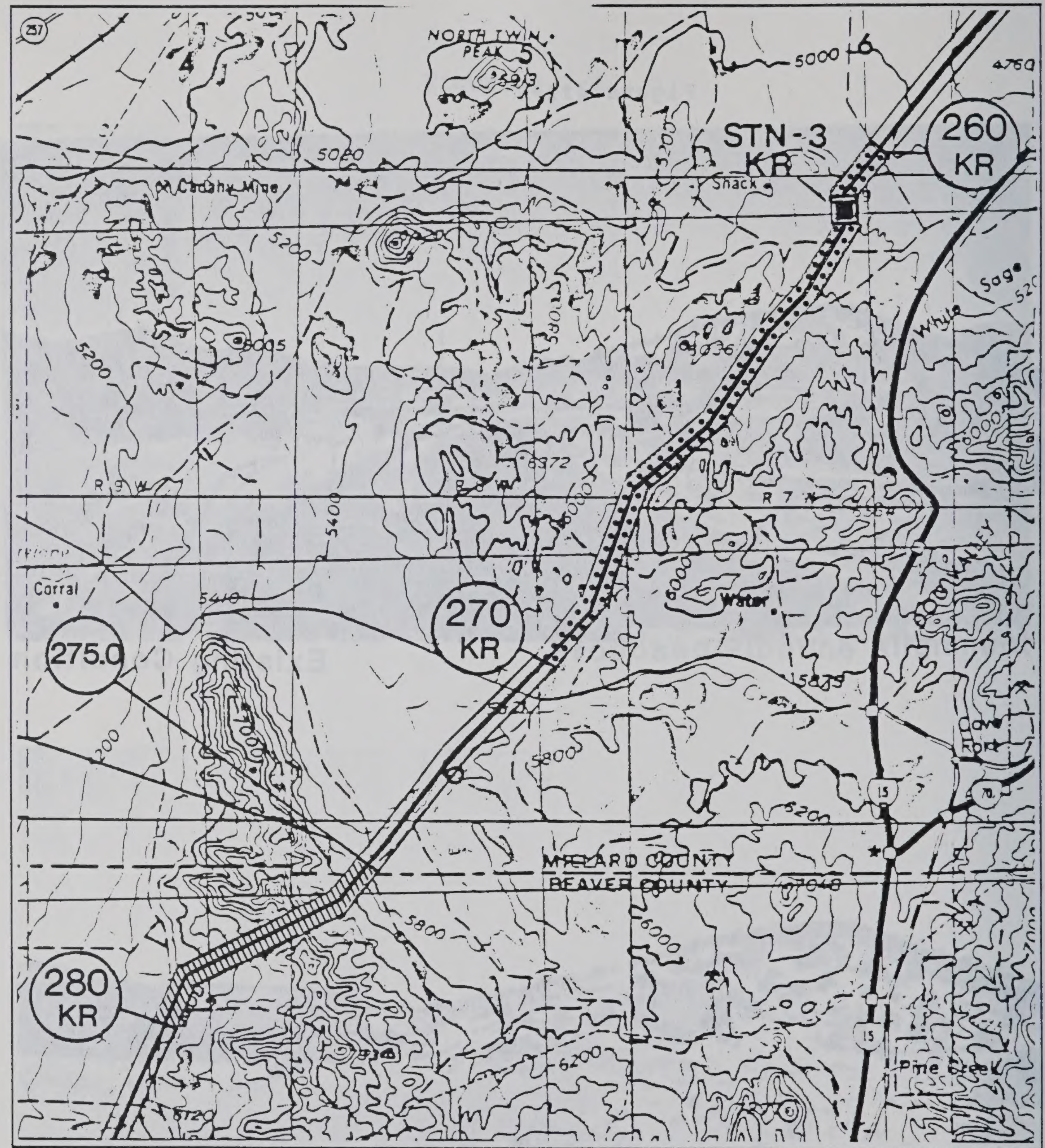
Existing Condition



Post-Construction
Visual Simulation

KERN RIVER PROPOSAL
SCIPIO PASS

Figure 4.2-8


257
NORTH TWIN PEAK
5913
5000
4760
STN-3 KR
260 KR
Shack
Cudahy Mine
5020
5200
6005
6036
6372
R 9 W
R 8 W
R 7 W
White Sage
5400
6000
Corral
5410
270 KR
275.0
Water
5875
Cove Fort
15
70
5800
5200
MILLARD COUNTY
BEAVER COUNTY
7048
7000
6000
280 KR
6200
6120
Pine Creek

LEGEND

■ PROPOSED COMPRESSOR STATION

═ PROPOSED PIPELINE

▭ PROPOSED ALTERNATIVE PIPELINE

(120 KR) PIPELINE MILEAGE (INTERVAL: 10 MILES)

(120.5) IMPACT MILEAGE

▩ HIGH IMPACT

▥ MODERATE IMPACT

⁘ LOW IMPACT

MOJAVE · KERN RIVER · EL DORADO NATURAL GAS PIPELINE PROJECTS

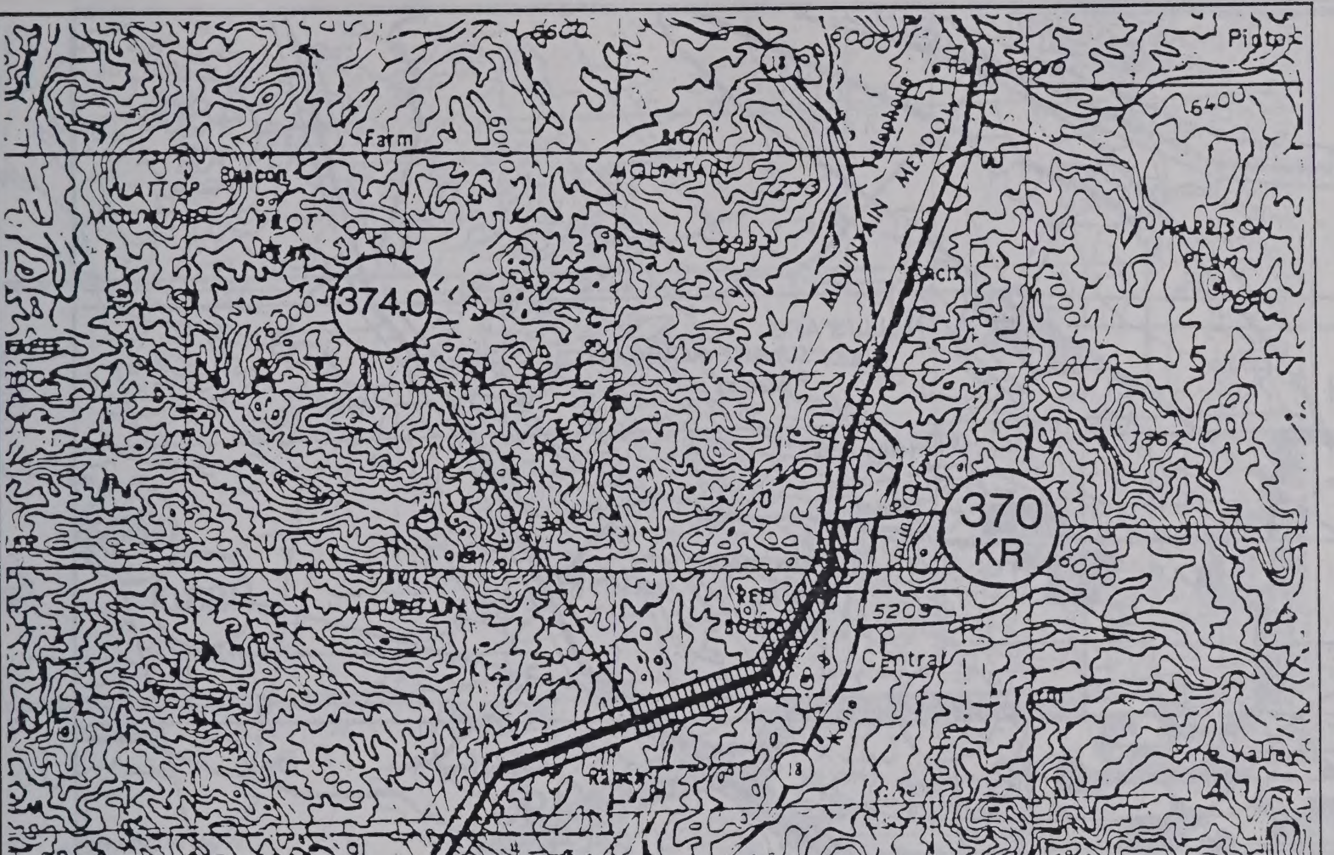
KERN RIVER PROPOSAL

NORTH ⊕

Scale (appx.)
0 .5 1 3
Miles

SOURCE: CHAMBERS GRP./SCOPING MTG.
TAKATA ASSOCIATES

Figure 4.2-9



374.0
370
KR
380
KR
Farm
BIG MOUNTAIN
FLATTOP MOUNTAIN
PILOT PEAK
NATIONAL
MOUNTAIN MEADOW
Pinto
6400
HARRISON PEAK
5205
Central
18
Utah Power House No 2
Veyo
Ranch
4565
Cedar Breaks

MOJAVE · KERN RIVER · EL DORADO NATURAL GAS PIPELINE PROJECTS

KERN RIVER PROPOSAL

LEGEND

■ PROPOSED COMPRESSOR STATION

═ PROPOSED PIPELINE

▭ PROPOSED ALTERNATIVE PIPELINE

120 KR PIPELINE MILEAGE (INTERVAL: 10 MILES)

120.5 IMPACT MILEAGE

▩ HIGH IMPACT

▥ MODERATE IMPACT

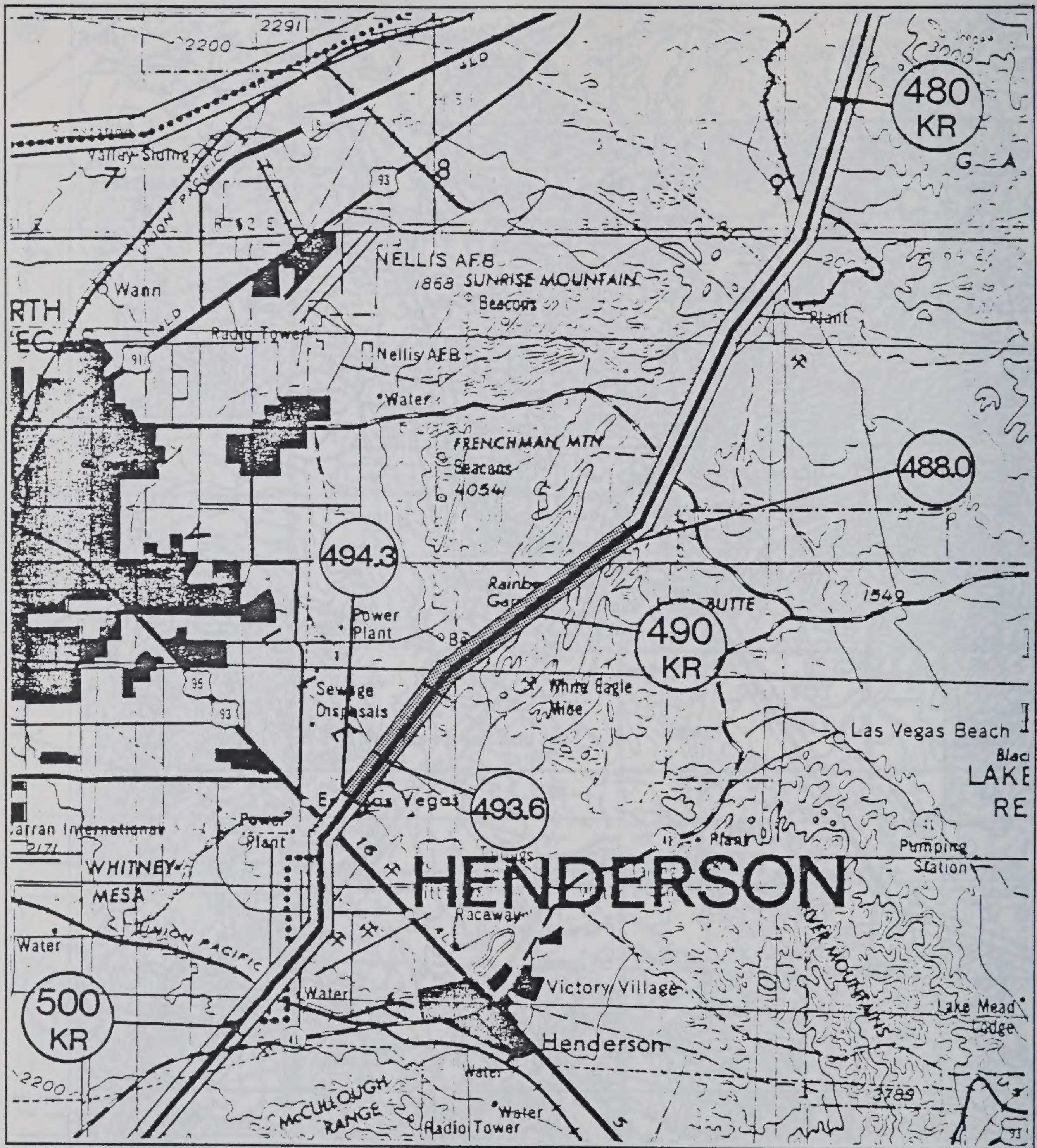
⁙ LOW IMPACT

NORTH ⊕

Scale (appx.)
0 .5 1 3
Miles

SOURCE: DIXIE NATIONAL FOREST
TAKATA ASSOCIATES

Figure 4.2-10

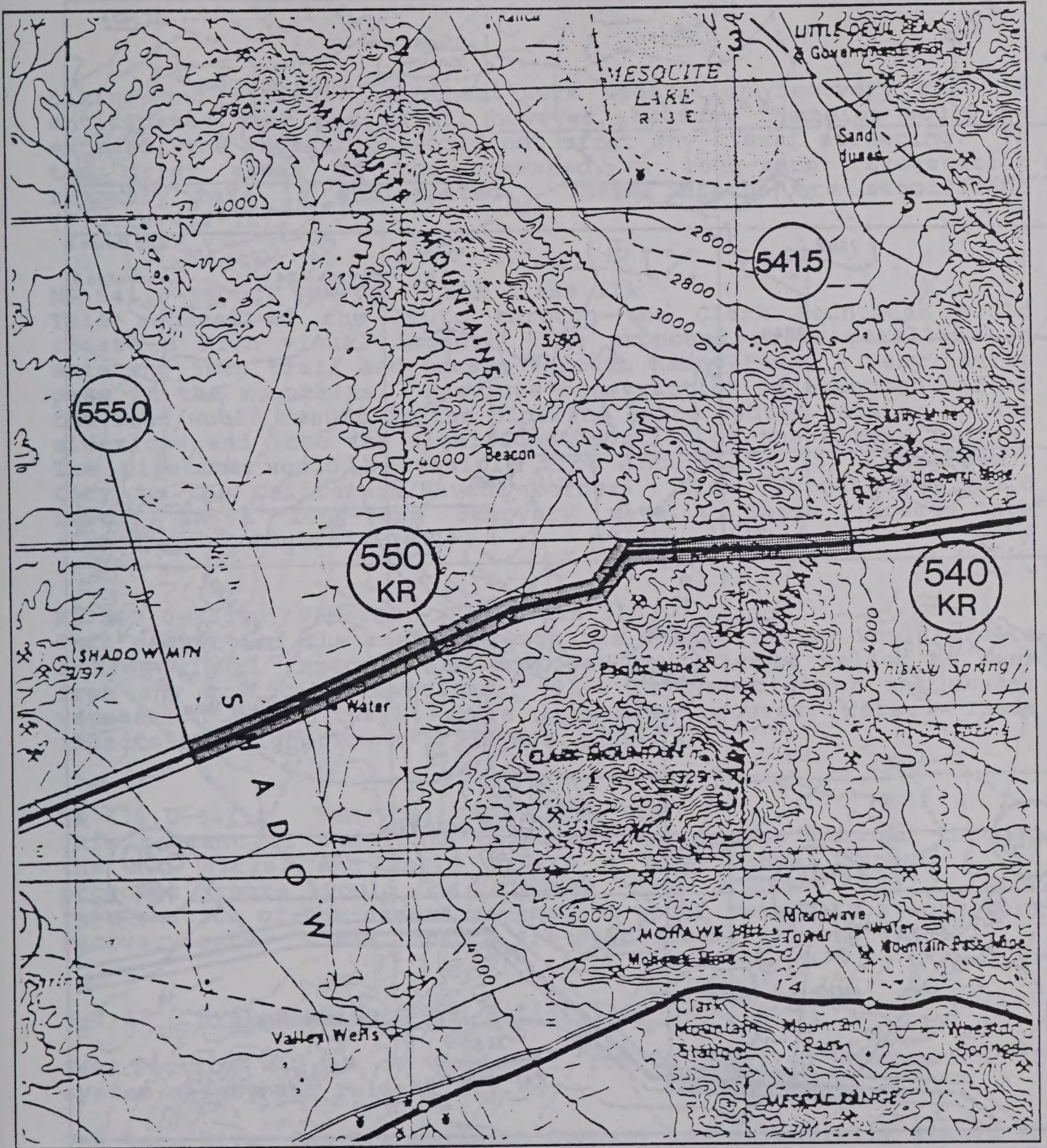

2291
2200
Valley Siding
UNION PACIFIC
15
93
8
7
R 62 E
NELLIS AFB
1868
SUNRISE MOUNTAIN
Beacons
Radio Tower
91
Nellis AFB
Water
FRENCHMAN MTN
Beacons
4054
Wann
480
KR
3000
G A
Plant
488.0
494.3
Rainbow Gardens
Power Plant
BUTTE
1549
490
KR
Sewage Disposals
White Eagle Mine
95
93
Las Vegas Beach
LAKE
East Las Vegas
493.6
McCarran International
2171
Power Plant
WHITNEY
MESA
HENDERSON
Raceway
Plant
Pumping Station
Water
UNION PACIFIC
500
KR
Water
41
Victory Village
Henderson
Lake Mead Lodge
2200
McCULLOUGH RANGE
Water
Water
Radio Tower
3789
5
93
LEGEND
PROPOSED COMPRESSOR STATION
PROPOSED PIPELINE
PROPOSED ALTERNATIVE PIPELINE
120 KR
PIPELINE MILEAGE (INTERVAL: 10 MILES)
120.5
IMPACT MILEAGE
HIGH IMPACT
MODERATE IMPACT
LOW IMPACT
NORTH
Scale (appx.)
0 .5 1 3
Miles

MOJAVE · KERN RIVER · EL DORADO
NATURAL GAS PIPELINE PROJECTS

KERN RIVER PROPOSAL

SOURCE: CHAMBERS GRP./SCOPING MTG.
TAKATA ASSOCIATES

Figure 4.2-11


2
3
5
3
UTTLE DEVIL PEAK
Government Well
MESQUITE LAKE
Sand Dunes
MESQUITE MOUNTAINS
4000
2600
2800
3000
541.5
5150
555.0
Beacon
4000
550 KR
540 KR
SHADOW MTN
5197
Water
Whisky Spring
CLARK MOUNTAIN
CLARK MOUNTAIN RANGE
SHADOW
5000
MOHAWK HILL
Microwave Tower
Mohawk Mine
Mountain Pass Mine
Clark Mountain Station
Mountain Pass
Wheaton Springs
Valley Wells
MESCAL RANGE
4000
15

LEGEND

■ PROPOSED COMPRESSOR STATION

━ PROPOSED PIPELINE

▭ PROPOSED ALTERNATIVE PIPELINE

(120 KR) PIPELINE MILEAGE (INTERVAL: 10 MILES)

(120.5) IMPACT MILEAGE

▒ HIGH IMPACT

▥ MODERATE IMPACT

⁘ LOW IMPACT

MOJAVE · KERN RIVER · EL DORADO
NATURAL GAS PIPELINE PROJECTS

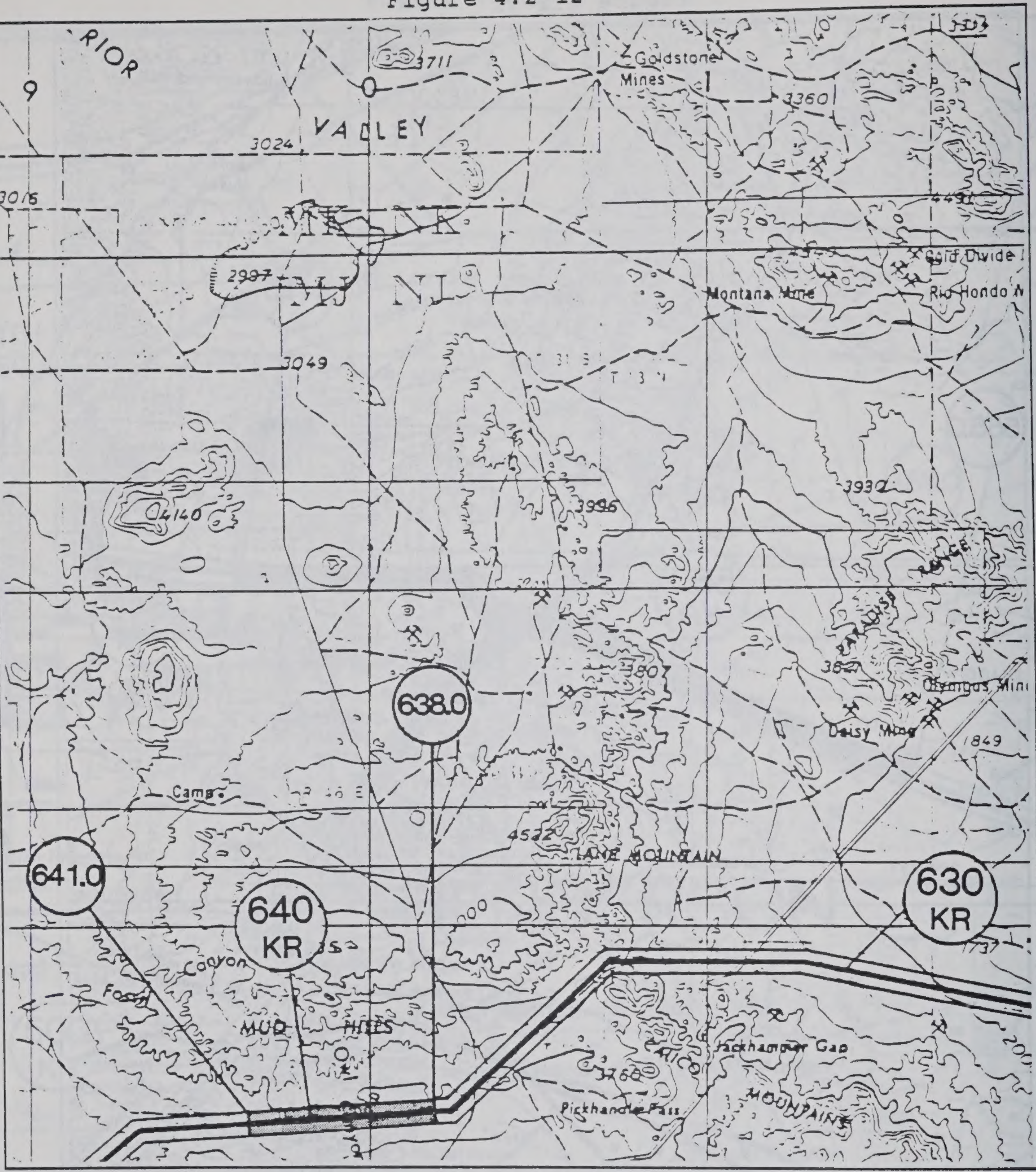
KERN RIVER PROPOSAL

NORTH ⊕

Scale (appx.)
0 .5 1 3
Miles

SOURCE: BUREAU OF LAND MANAGEMENT
TAKATA ASSOCIATES

Figure 4.2-12


RIOR
9
3711
VALLEY
3024
3015
Goldstone
Mines
3360
4491
2987
3049
Gold Divide
Montana Mine
Rio Hondo M
3930
3996
4140
PARADISE RANGE
3807
3827
Olympus Mine
Daisy Mine
1849
638.0
Camp
4522
LANE MOUNTAIN
641.0
640
KR
630
KR
1737
Canyon
Fossil
MUD HILLS
Jackhammer Gap
CALICO MOUNTAINS
3760
Pickhandle Pass

LEGEND

■ PROPOSED COMPRESSOR STATION

═ PROPOSED PIPELINE

▭ PROPOSED ALTERNATIVE PIPELINE

(120 KR) PIPELINE MILEAGE (INTERVAL: 10 MILES)

(120.5) IMPACT MILEAGE

▨ HIGH IMPACT

▥ MODERATE IMPACT

⁙ LOW IMPACT

MOJAVE • KERN RIVER • EL DORADO NATURAL GAS PIPELINE PROJECTS

KERN RIVER PROPOSAL

NORTH ⊕

Scale (appx.)
0 .5 1 3
Miles

SOURCE: BUREAU OF LAND MANAGEMENT
TAKATA ASSOCIATES

hiking and riding). A short-term vegetation recovery rate is anticipated near the water; however, because the pipe would be exposed, the vegetation would not offer any visual screening. In the drier areas of the viewshed, a long-term revegetation recovery rate is anticipated. These impacts are significant (Figure 4.2-10).

MP 541.5-550.0, VRM/VQO: BLM Class IIA
This segment of the route through the Clark Mountains would create a high visual impact. The proposed route parallels an existing jeep trail and passes through Keany Pass, a very narrow pass in the mountains. Previous construction adjacent to and in the road would result in the pipeline being routed farther up the sideslope and into the significant portion of the Class II area. The pipeline would be visible from Interstate 15, from Desert City to the California/Nevada border. Slow revegetation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-11).

MP 550.0-555.0, VRM/VQO: BLM Class IIB
This segment of the route through the Shadow Valley would create a high visual impact. The proposed route would seldom be seen from any critical viewpoints. Slow rejuvenation of the desert vegetation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-11).

MP 638.0-641.0, VRM/VQO: BLM Class IIB
This segment of the route parallels an unimproved road through the Mud Hills, and would create a high visual impact. The proposed route would be visible from Highway 395. Slow rejuvenation of the desert vegetation would result in a long-term recovery rate. These impacts are significant (Figure 4.2-12).

4.2.13 Systems Safety and Reliability

See Section 4.2.13 of Volume I for a detailed discussion of system safety and reliability.

The Kern River Gas Transmission Company has essentially stated in its application that its pipeline will be designed, constructed, and operated in accordance with the appropriate laws, regulations, and standards. The application does state that the compressor stations could be shut down either remotely or automatically. Shutdowns will be accomplished automatically for various operating reasons. For example, the compressor station will be shut down if: an excessive heat rise is detected in the compressor building; if flames are detected by ultraviolet sensors; or if gas is detected by methane-sensitive detectors.

Kern River Gas Transmission Company has stated that the pipeline crossings of faults will be designed to remain operable after an Operating Level Earthquake (OLE). The OLE is defined as the earthquake which would have a 50 percent probability of not being exceeded during a 50-year period. In addition, they have stated that the pipeline monitoring control and communication systems will be designed to continue functioning after a Contingency Level Earthquake (CLE). The CLE is defined as the earthquake which has a 90 percent probability of not being exceeded.

Table 4.2-22 identifies areas along the Kern River pipeline route which may be particularly sensitive to the construction and operation of the pipeline from a safety aspect and also areas which have the potential to cause pipeline accidents. Section 3.1.9 presents details on land uses along the route and Sections 3.1.2 and 4.2.2 describe the geologic conditions and impacts.

The many and active geologic hazards along the mainline in Utah will increase construction and maintenance costs. The pipeline will be susceptible to damage, causing inoperable conditions. Such damage and breaks in operations may occur at frequent intervals, due to geologic conditions and weather patterns.

Maintenance and minor repairs to the pipeline may be delayed as a result of seasonal access restrictions imposed by the Forest Service. Weather conditions, natural resource concerns, and management direction provided by approved Forest Plans will dictate when access to the pipeline will be permitted. There could be some effect on the schedule delivery of gas as a result of these restrictions.

The route passes through areas of undeveloped, subdivided tracts within the corporate limits of Henderson. This could introduce populated areas along the route in this area in the future. Also, excavation activity would take place during the development which could damage the pipeline.

The area where the pipeline route passes through Brite Valley near Tehachapi may be particularly sensitive since the pipeline crosses faults on either side of this residential area.

The Taft Lateral does not pass through any residential areas. It does pass near Taft (MP 30) near where it crosses a potentially active fault.

The Kern River Lateral passes near residential areas of Lamont (MP 11) then passes through a residential area of Bakersfield (MP 18 through MP 25). More residential subdivision activity is planned for this area possibly introducing more population [City of Bakersfield Fire Department letter, May, 1986]. In addition, this activity will require the installation of sewers, water mains, and other utilities which involve excavation that could inadvertently damage the proposed gas transmission line. The route also crosses several faults in this area.

Table 4.2-22

ANALYSIS OF POTENTIAL VULNERABLE RESOURCES AND GEOLOGICAL HAZARDS, KERN RIVER PROPOSAL

Location	Potential Vulnerable Resources	Potential Causes of Accidents
Mainline		
MP 95-98	Within 1/2 mile of a residential area in Kamas Valley	
MP 139	Within 1/2 mile of Uinta NF campground	
MP 229	Within 1/2 mile of Holden, Utah	
MP 184-290		Several fault crossings
MP 354	Within 1/2 mile of Newcastle, Utah	
MP 496-510	Through residential areas of Henderson, Nevada, and near East Las Vegas, Nevada	
MP 720	Near residential area south of Tehachapi, California	
MP 724-726		Garlock Fault crossing
MP 735	Near residential area in Brite Valley, California	
MP 761		White Wolf fault crossing
Kern River Lateral		
MP 11-13	Near residential area of Lamont, California	
MP 18-25	Through residential area of Bakersfield, California	
MP 22		Several fault crossings
Taft Lateral		
MP 30	Near Taft, California	Buena Vista fault crossing

4.3 NORTHWEST PROPOSAL

Because the proposed mainline tap and metering facilities would be extremely minor and would be constructed entirely within Northwest's existing Muddy Creek Compressor Station yard, environmental impact associated with construction of the facilities would be insignificant. While a finite amount of air emissions, construction noise, and waste materials would be generated during construction, all would be of temporary nature. Facility construction would probably occur concurrent with construction of Kern River's Compressor Station No. 1, and if so would be completely obscured by the major activities associated wtih Kern River facilities.

No significant environmental imapcts would result from operation or ultimate abandonment of Northwest's proposed tap and metering facilities, nor would cumulative impacts or unavoidable adverse impacts be expected.

4.4 KERN RIVER ROUTE VARIATIONS

4.4.1 Wasatch Variation

4.4.1.1 Air Quality

Air quality emissions and impacts would be essentially the same as under the proposed primary route which was presented in Section 4.2.1. Total overall construction emissions would be slightly higher due to an increase in length of about 20 miles.

Operation phase emissions and associated impacts would be slightly higher at Compressor Station Nos. 3 and 5 than those presented in Section 4.2.1 due to a required 400 hp compression increase.

4.4.1.2 Geology

Refer to Section 4.2.2. Potential geologic impacts are summarized in Table 4.4-1.

4.4.1.2.1 Seismicity and Faulting

The alternate route would cross the Warm Springs segment of the Wasatch Fault just north of Salt Lake City and the West Valley fault zone just west of Salt Lake City International Airport. Potential impacts associated with fault crossings are similar to those discussed in Section 4.2.2.1 of this document. The one exception in the Salt Lake Valley is the presence of a large area along this proposed variation which is underlain by soils which have been mapped as being prone to liquefaction [Anderson et al., 1984]. Weber River Valley alluvium may be similarly susceptible.

Table 4.4-1

SIGNIFICANT GEOLOGICAL HAZARDS, WASATCH VARIATION

Mile-post	Location	Liquefaction/ Ground Failure	Surface Fault Rupture	Slope Instability	Ground Subsidence	Flash Flooding	Avalanche
15-16	Weber River Alluvium	X	–	–	–	–	–
40-49	Wasatch Front	–	–	X	–	X	–
49-57	North Salt Lake to US 40	–	X	–	–	–	–
49-153	Bountiful to South Jordan	X	–	–	–	–	–

Liquefied soils may undergo large displacements where the ground surface slopes as little as 0.5 percent.

4.4.1.2.2 Slope Stability

The instability features identified along this variation (see Section 3.2.1.2) are localized and of limited extent when compared to the large landslides identified along the primary route. No areas of instability which would be difficult to cross were identified by Golder Associates [1986] in their geotechnical analysis. However, both the Forest Service [1986c] and the Utah Geologic and Mineral Survey [Kaliser, 1986] have identified numerous instability features, as did an aerial reconnaissance survey of the area during 1986.

The recent geologic hazard history of the area, in conjunction with the existence of numerous visible cracks and seeps, implies that considerable potential for additional instability is present. There are areas between Walbrook and Mill Creek Canyons where the route descends steep concave slopes where these hazards are present. Although the majority of the alignment is located primarily on ridges, the ridges themselves are quite steep and do not necessarily imply stability. In addition, the potential exists for altering subsurface water flow through pipeline trenching and road construction activities. Groundwater flow alteration could create instability and increase geologic hazards in the canyon areas along the west side of the Wasatch Front.

The above considerations and the relative lack of detailed geotechnical information for the area of concern indicate a strong possibility of significant impacts due to slope instability. The affects of such problems associated with pipeline construction and long-term stability are addressed in Section 4.2.2.3.

4.4.1.2.3 Subsidence

Hydrocompaction within the Basin and Range region has been discussed in Section 4.2.2.4.

4.4.1.2.4 Flash Floods and Debris Flows

Comments made with respect to the proposed mainline in Section 4.2.2.5 also apply to the Wasatch Variation route.

4.4.1.2.5 Volcanics

This variation would not be subject to hazards from volcanism.

4.4.1.2.6 Avalanches

The high mountain portions of this variation would cross through potential avalanche zones. However, this area is not as prone to be affected by large, deep seated slab avalanches as in other high mountain areas of the Middle Rocky Mountains. For additional information of the potential effects of avalanches, see Section 4.2.2.7.

4.4.1.2.7 Mineral/Petroleum Resources

No significant adverse impact to active or planned mineral resource development is expected to result from implementation of this route variation.

4.4.1.2.8 Unique Geologic Features

No such features are known to occur along the route of this proposed variation.

4.4.1.3 Soil

Refer to Section 4.2.3 for a general discussion on impacts that could occur to soils due to pipeline construction, criteria used to delineate significant impacts, as well as a general description of methodology used to assess impacts. The distribution of potential soils impacts is summarized in Table 4.4-2.

4.4.1.3.1 Middle Rocky Mountains (MP 0-49)

In the Middle Rocky Mountains area, the probability for significant water erosion is mostly high, and the probability for significant wind erosion is moderately low. Reclamation potential is mostly fair and poor, indicating significant revegetation problems.

4.4.1.3.2 Basin and Range (MP 49-154)

In the Basin and Range area, the probability for significant water and wind erosion is mostly low and moderate. Reclamation potential is distributed across the good to poor range with areas that would be likely to have significant revegetation problems scattered along the route.

Table 4.4-2

DISTRIBUTION OF POTENTIAL SOILS IMPACTS, WASATCH VARIATION

		Erosion Potential [1]						Reclamation Potential [2]		
		Water (miles) [3]			Wind (miles) [3]			(miles) [3]		
Milepost	Geographic Area	L	M	H	L	M	H	G	F	P
0.0-48.5	Middle Rocky Mtns	4.0	11.5	33.0	47.0	1.5	0.0	2.0	18.5	28.0
8.5-154.0	Basin and Range	88.0	15.5	2.0	69.5	36.0	0.0	54.5	21.0	30.0

---

[1] Water Erosion Potential

L(low) = less than 5 tons/acre/year (low probability for significant erosion impacts).
M(moderate) = 5 to 20 tons/acre/year (near even probability for significant erosion impacts).
H(high) = greater than 20 tons/acre/year (high probability for significant erosion impacts).

Wind Erosion Potential

L(low) = low probability for significant erosion impact.
M(moderate) = near even probability for significant erosion impacts. Impact potential also dependent upon site specific exposure to prevailing winds.
H(high) = high probability for significant erosion impacts. Impact potential also dependent upon site specific exposure to prevailing winds.

[2] Reclamation Potential

Ratings are based upon trenching with no selective soil handling or other mitigation.
G(good) = good probability for restoring vegetation which will support pre-existing land use. Productivity potential may be somewhat reduced.
F(fair) = near even probability for restoring vegetation which will support pre-existing land use within short periods of time. Time needed for reestablishment is likely to be longer than soils with good potential. Productivity potential may be reduced.
P(poor) = low probability for restoring vegetation which will support pre-existing land use within a short period of time. Time needed for reestablishment is likely to be long. Productivity potential may be reduced.

[3] Cumulative miles for pipeline segment.

4.4.1.4 Surface Water

Comments made in Section 4.2.4 regarding general impacts that could occur to surface water resources due to pipeline construction as well as the criteria used to identify significant impacts apply to this variation.

4.4.1.4.1 Middle Rocky Mountains

Approximately 16 perennial streams would be crossed by this variation within this region. These streams predominantly have moderate to high sensitivities to pipeline construction. Specific impacts that would occur within this region would be very similar to those described in the Kern River mainline, Section 4.2.4.1.2. The potential for significant impact to surface water is high due to the steep terrain and relatively high sensitivity of the streams. The variation would traverse the Mill Creek municipal watershed managed by the Forest Service and the City of Bountiful, Utah, for the production of domestic water. The potential for significantly degrading the water quality in this watershed as a result of pipeline construction, operation, and abandonment is high. A source of water for hydrostatically testing the pipeline has not been identified. It is assumed that since no major stream or river is crossed by the route that water would be withdrawn from several streams with relatively low discharges. The potential for significant impacts due to dewatering would be high for these streams.

4.4.1.4.2 Basin and Range

Approximately three perennial streams would be crossed within this region by the variation. Of particular note are the Jordan and Sevier Rivers, which are major water bodies in the region. These streams have generally low sensitivities to pipeline construction. Consequently, no significant impacts are expected as a result of construction through the streams. Both rivers have substantial associated riverine wetlands. Construction of the pipeline through these wetlands could impact the movement of both surface and subsurface water, but would not be considered significant. The terrain that would be crossed by the route is relatively flat for the most part and hence impacts caused by increased surface runoff are not expected to be significant. Numerous intermittent and ephemeral streams would be crossed by the pipeline. Impacts associated with pipeline construction across these channels would be identical to those described previously in Section 4.2.4.1.3. Approximately seven irrigation canals and ditches would be crossed. Impacts caused by construction across these canals and ditches would not be significant if flows were not impeded or water quality was not impacted. No sources of surface water have been identified for use in hydrostatic testing within this region. Impacts associated with water withdrawal for these purposes were previously described.

4.4.1.5 Groundwater

See the discussion under Slope Stability for potential effects to groundwater. There is a medium to high degree of potential impacts to groundwater in localized areas of surface seepage on the Mill Creek drainage. There is a shallow water table and moderate use for domestic water supplies in these areas.

A low potential for significant impact occurs at most other locations along this variation, where, although the use of groundwater is moderate to high, the depth to the water table is great.

4.4.1.6 Freshwater Biology

Impacts resulting from construction of the Wasatch Variation on aquatic resources within the Middle Rocky Mountain and Basin and Range regions are presented in Table 4.4-3.

Table 4.4-3

SIGNIFICANCE OF IMPACTS ON AQUATIC COMMUNITIES, WASATCH VARIATION

Utah County	Stream	Approximate Milepost	Impacts 1/
Middle Rocky Mountains (MP 0-48.5)			
Summit	South Fork Chalk Crk	8.8	NS
	Chalk Creek	10.0	S
	Weber River	15.5	NS
	Franklin Canyon	20.6	NS
Morgan	Dixie Hollow	25.0	NS
	E. Canyon Crk	28.8	S
	Sheep Canyon	29.9	S
	Woods Creek	31.5	NS
	Hardscrabble Creek	35.5	S
	Beaver Creek	35.5	S
	Mill Creek	42.9	S
Basin and Range (MP 48.5-154)			
Davis	Jordan River	50.0	NS
Juab	Sevier River	149.0	NS

1/ NS - not significant
S - significant

Thirteen different streams would be crossed by the pipeline. Six streams, all within the Middle Rocky Mountain region, could be significantly impacted by construction activities. One stream, Beaver Creek, is rated as a Class A stream and is considered sensitive due to the high quality spawning and nursery areas present for game fish. The State of Utah considers this stream to be critical habitat. Critical habitat designation by the state indicates that for mitigation purposes, no loss of habitat value is acceptable. An additional five streams would be crossed are considered Class B streams and are in areas of high gradient and/or steep sideslopes.

4.4.1.7 Terrestrial Biology

4.4.1.7.1 Vegetation

General Vegetation. Approximately 1,280 acres of vegetation would be denuded by construction of the proposed Wasatch Variation. Table 4.4-4 lists the vegetation types and acreages of each type that would be removed during construction. No Class I impacts would occur due to construction of this variation. Approximately 570 acres of Class II impacts would occur including 125 acres of wetland/riparian primarily associated with the Jordan and Sevier Rivers and several small perennial and intermittent drainages along the proposed route, 425 acres of agricultural land, and 20 acres of montane forest.

Plant Species of Special Concern. No plant species of special concern are known to occur along the pipeline route or in the general vicinity of the route. Therefore, no significant impacts would occur.

4.4.1.7.2 Wildlife

Criteria used to determine significance of impacts and general impacts associated with construction of the proposed Wasatch Variation are the same as those described in Section 4.2.7.2. Significant impacts to general wildlife are identified and tabulated in Table 4.4-5. The presence of species of special interest along the proposed variation is shown in Table 3.2-5.

General Wildlife. Critical and high priority mule deer, elk and moose winter range would be crossed by the Wasatch Variation. Disturbance to big game during winter stress periods would be a Class II impact. Loss of habitat would also be a Class II impact on one limited critical elk winter range. Loss of other big game winter habitat would be a Class III impact.

Table 4.4-4

VEGETATION TYPES AND DENUDED ACREAGES, WASATCH VARIATION

Geographic Region	Vegetation Type	Impact Class[2]	Denudation[1] (acres) Short Term[3]	Long Term[4]	Permanent[5]	Total
Middle Rocky Mountains	Mountain brush	III	151.5	151.5	0	303.0
	Pinyon-Juniper woodland	III	6.0	6.1	0	12.1
	Sagebrush scrub	III	211.0	0	0	211.0
	Agricultural land/Urban	II	36.4	0	0	36.4
	Montane forest	II	11.6	11.6	0	23.2
	Wetland/riparian	II	2.1	0	0	2.1
		Subtotal	418.6	169.2	0	587.8
Basin and Range	Pinyon-Juniper woodland	III	121.2	121.2	0	242.4
	Sagebrush scrub	III	406.0	0	0	406.0
	Urban	III	72.7	0	0	72.7
	Agricultural land	II	387.8	0	0	387.8
	Utah grassland	III	48.5	0	0	48.5
	Wetland/riparian	II	121.2	0	0	121.2
		Subtotal	1,157.4	121.2	0	1,278.6
Summary by Type						
	Mountain brush	III	151.5	151.5	0	303.0
	Pinyon-Juniper woodland	III	127.2	127.3	0	254.5
	Sagebrush scrub	III	617.0	0	0	617.0
	Agricultural land	II	424.2	0	0	424.2
	Montane forest	II	11.6	11.6	0	23.2
	Wetland/riparian	II	123.3	0	0	123.3
	Urban	III	72.7	0	0	72.7
	Utah grassland	III	48.5	0	0	48.5
		TOTAL	1,576.0	290.4	0	1,866.4

Table 4.4-4 (continued)

VEGETATION TYPES AND DENUDED ACREAGES, WASATCH VARIATION

			Denudation [1/] (acres)			
Geographic Region	Vegetation Type	Impact Class [2/]	Short Term [3/]	Long Term [4/]	Permanent [5/]	Total
Summary By Impact Class [2/]						
	Class	I	0	0	0	0
	Class	II	559.1	11.6	0	570.7
	Class	III	1016.9	278.8	0	1295.7
	Class	IV	0	0	0	0
		TOTAL	1576.0	290.4	0	1866.4

[1/] vegetation loss assuming a 100-foot wide construction ROW and a 50-foot wide operational ROW.

[2/] see section 4.2.7.1 for definitions of impact classes.

[3/] short term loss = vegetation loss within community types with fair or better revegetation potential; vegetation loss within total 100-foot wide construction ROW if large woody shrubs or trees not present; vegetation loss short term within the 50-foot wide portion of the construction ROW not used for operation with large woody shrubs and trees present; vegetation loss would not be significant.

[4/] long term loss = loss of vegetation within community types with fair or better revegetation potential containing large woody shrubs or trees present in operational ROW (50-foot wide) which would hamper operations and, therefore, would not be allowed to re-establish in the operational ROW during the life of the project; vegetation loss would not be significant.

[5/] permanent loss = loss of vegetation within community types with poor or worse revegetation potential; vegetation loss would be significant.

Table 4.4-5

SIGNIFICANT WILDLIFE IMPACTS, WASATCH VARIATION

Milepost or feature	Wildlife groups and life requisites impacted [1]			
	Wintering big game [2]	Nesting/breeding sage grouse	Nesting/brooding waterfowl	Nesting raptors
0-20	E,M,MD	-	-	-
21-40	MD	x [3]	-	-
41-60	-	-	-	-
61-80	-	-	-	-
81-100	-	-	-	1 nest
101-120	-	-	-	6 nests
121-140	MD	-	-	-
141-154 (end)	MD	-	x [3]	-

---

[1] Impacts are delineated by species, where possible, and include both habitat and population related impacts unless specifically stated in the table.

[2] Big game species include mule deer (MD), elk (E), moose (M) and pronghorn (P).

[3] An "x" signifies that an impact occurs within the milepost designation

One sage grouse buffer zone associated with a courtship area would be disturbed by the proposed pipeline. Seven raptor nests are located within the pipeline corridor in the vicinity of the Lake Mountains immediately west of Utah Lake. Construction activities during breeding/nesting would be a Class II impact to sage grouse and raptors.

One critical goose nesting and brooding area would be traversed for approximately two miles near the Sevier River. Loss of nesting habitat would be a Class II impact. Because of their propensity to renest, construction activities would cause only a short-term disturbance, and would be a Class III impact to individuals.

Wildlife Species of Special Concern. Bald eagle winter concentration areas and one bald eagle winter roost have been identified within the area of concern. Construction activities during winter use of these habitats would be a Class II impact.

Two ferruginous hawk nests occur along the proposed line. Additional ferruginous and Swainson's hawk nests potentially occur along the alignment. Construction activities at these sites during active nesting would be a Class II impact.

4.4.1.7.3 Grazing

Criteria used to evaluate potential impacts to grazing along these proposed route variations are the same as those listed in Section 4.2.7.3.

The proposed route variation involves less than one percent of any allotment that would be traversed or traverse private lands (Appendix D); therefore, no significant impacts to grazing would occur.

4.4.1.8 Socioeconomics

4.4.1.8.1 Population, Housing, and Economic Impacts

The anticipated socioeconomic impacts are very similar to the proposed mainline project. The impacts of this variation may be slightly greater as a result of the increase in length of about 20 miles and an increase in compression of 400 hp.

4.4.1.8.2 Traffic

Those areas in the Wasatch NF which have no access from major highways or access is by Forest roads to the route of the variation (see Section 3.2.1.8.2) would be adversely impacted by the construction of heavy haul roads. Existing Forest Roads to be used for construction activities would require reconstruction to heavy haul standards. New road construction or reconstruction of existing roads may not be permitted, depending on terrain and natural resource conditions and values. On existing roads used, there would be increased traffic, with resulting safety and maintenance concerns. For new road construction, there would be new disturbance to soil, water, and wildlife resources and possible entry into previously unroaded areas.

In Salt Lake County, three state highways and I-80 would be crossed; all have high traffic counts. Since crossings would be made by boring under the pavement, no delays are expected.

4.4.1.8.3 Noise

Pipeline construction along the route variation would cause the same types of impacts as those discussed in Section 4.2.8.3. This variation, however, would contain a significant number of noise receptors within 250 feet of the construction ROW between MP 60 and 70 and thus noise levels could potentially exceed 65 dBA. Increased noise levels would be short-term, lasting generally fewer than 10 working days at any particular point along the route. Temporary noise increases would be of greater impact where construction occurs in or adjacent to residential areas and schools. Due to the temporary nature of the construction, noise will not be considered to be a significant impact.

Construction of the Wasatch Variation would still require three compressor stations. Neither the location nor the horsepower of proposed Compressor Station No. 1 would be altered. The impacts therefore would remain the same as those discussed in Section 4.2.8.3. Compressor Stations Nos. 3 and 5 would require relocation. Compressor Station No. 3 would be placed approximately 20 miles north of its proposed location to the Pavant Valley about five miles west of Meadow, Utah. This station would also require a 400 hp increase in compression to 9,500 hp. Since the exact location of the compressor station has not been determined, the exact impact cannot be quantified.

Compressor Station No. 5 would also have to be relocated about 10 miles northeast of its proposed location to a position approximately 14 miles southwest of Henderson, Nevada. A similar 400 hp increase in compression would be required at this station, totalling 10,300 hp. Again since the exact location of the compressor station has not been determined, the exact impact cannot be quantified.

4.4.1.8.4 Recreational Resources

The developed picnic area on Mill Creek (Mueller Park) lies within the mile-wide study corridor, but since the construction corridor is only 75 feet wide, direct impact to in-place facilities can be avoided. No camping or trailer spaces are in

Mueller Park. Other nearby campgrounds in the Wasatch-Cache National Forest may experience competition for space, but since there is an excess of supply over demand for motel rooms and RV spaces in and near Salt Lake City, competition is expected to be minimal. Other short-term impacts would include increased noise, dust, and inconvenience of access. The three trails near Mueller Park crossed by the pipeline would receive short-term impacts during construction and long-term impacts on the visual resources.

There are 3.5 miles of pipeline within areas designated as Semiprimitive Nonmotorized land which would be compromised if access by off-road vehicles were not controlled.

The designated open space along the Jordon River in Salt Lake City would be crossed by the proposed pipeline. Construction of the pipeline would temporarily disturb the intended tranquility of this green belt within an urban setting.

4.4.1.9 Land Ownership/Use

There would be a significant impact to the Wasatch-Cache National Forest Land and Resource Management Plan because the proposed route is not within an existing utility corridor. Refer to Appendix F for a detailed discussion of Forest Plans. Potential short- and long-term impacts could occur in Salt Lake Valley to residential uses.

A short-term impact on Camp Williams, southwest of Salt Lake City, would occur when traffic on their roads to maneuver areas is delayed by construction activities. Air traffic on their landing strip may also be impacted for short periods.

Refer to Table 4.4-6 for construction and operation disturbance by land ownership for the Wasatch Variation. Table 4.4-7 shows the number of acres that would be disturbed by land use.

4.4.1.10 Cultural Resources

4.4.1.10.1 Archaeology

Direct Impacts. Five known sites are situated in the zone of direct impact, including a quarry site, two lithic scatters, a rock feature and a campsite. Only 0.6 percent of the direct impact zone has been surveyed.

Indirect Impacts. Seven known sites fall in the zone of indirect impact: three campsites, two rock features, a historic cemetery, and the historic Hostess House at Camp Williams which has been nominated to the National Register.

Table 4.4-6

CONSTRUCTION AND OPERATION DISTURBANCE BY LAND OWNERSHIP, WASATCH VARIATION

State, County,	Disturbance Area	Total Acres	Private Acres	BLM Acres	State Acres	FS Acres	DOD Acres
UTAH							
Summit	100' Construction	276.4	276.4	-	-	-	-
	50' Operation	138.2	138.24	-	-	-	-
Morgan	100' Construction	196.4	168.5	-	-	27.9	-
	50' Operation	98.2	84.3	-	-	13.9	-
Davis	100' Construction	133.3	90.9	-	-	42.4	-
	50' Operation	66.7	45.5	-	-	21.2	-
Salt Lake	100' Construction	387.9	369.7	-	-	-	18.2
	50' Operation	193.9	184.8	-	-	-	9.1
Utah	100' Construction	557.6	458.2	18.2	75.2	-	6.1
	50' Operation	278.8	229.1	9.1	37.6	-	3.0
Juab	100' Construction	315.2	237.6	72.7	4.8	-	-
	50' Operation	157.6	118.8	36.4	2.4	-	-
Total	100' Construction	1866.7	1601.2	90.9	80.0	70.3	24.2
	50' Operation	933.3	800.6	45.5	40.0	35.2	12.1

Table 4.4-7

CONSTRUCTION AND OPERATION DISTURBANCE BY LAND USE, WASATCH VARIATION

State, County	Disturbance Area	Total Acres	Grazing/ Rangeland Acres	Timber/ Forest Acres	Irrigated/ Non-irrigated Agriculture Acres	Industrial Acres	Residential Acres	Other Acres
UTAH								
Summit	100' Construction	276.4	276.4	-	-	-	-	-
	50' Operation	138.2	138.2	-	-	-	-	-
Morgan	100' Construction	196.4	144.2	27.9	24.2	-	-	-
	50' Operation	98.2	72.1	13.9	12.1	-	-	-
Davis	100' Construction	133.3	78.8	42.4	-	12.1	-	-
	50' Operation	66.7	39.4	21.2	-	6.1	-	-
Salt Lake	100' Construction	387.9	72.7	-	145.5	84.8	66.7	18.2
	50' Operation	193.9	36.4	-	72.7	42.4	33.3	9.1
Utah	100' Construction	557.6	551.5	-	-	-	-	6.1
	50' Operation	278.8	275.8	-	-	-	-	3.0
Juab	100' Construction	315.2	315.2	-	-	-	-	-
	50' Operation	157.6	157.6	-	-	-	-	-
Total	100' Construction	1866.7	1438.8	70.3	169.7	97.0	66.7	24.3
	50' Operation	933.3	719.4	35.2	84.8	48.5	33.3	12.1

4.4.1.10.2 American Indian Concerns

The Ute Indian Tribe of Utah is concerned about impacts to ancestral (archaeological) sites listed above. See also Section 4.2.10.2.

4.4.1.11 Paleontological Resources

The variation would traverse 141.6 miles of significant formations, 5.1 miles of undetermined significance and 7.3 miles of formations which are not significant.

4.4.1.12 Visual Resources

Refer to Section 4.2.12 for methodology. See Table 4.4-8 for visual impact analysis. Figures 4.4-1 and 4.4-2 show the route and a post-construction visual simulation on Wasatch Ridge.

MP 36.4-38.4, VRM/VQO: FS Class PR
This segment of the proposed route through the Wasatch-Cache National Forest crosses Mill Creek and would have a low adverse visual impact. The pipeline would be visible from the local roads. Slow revegetation would result in a long-term recovery rate. These impacts are not significant (Figure 4.4-3).

MP 39.9-40.2, VRM/VQO: FS Class PR
This segment of the proposed route through the Wasatch-Cache National Forest would have a high visual impact. The pipeline would be highly visible from the Bountiful City area. Slow revegetation would result in a long-term recovery rate. These impacts are significant (Figure 4.4-3).

MP 41.4-43.4, VRM/VQO: FS Class R
This segment of the proposed route through the Wasatch-Cache National Forest would have a high visual impact. The pipeline would be highly visible from Mueller Park. Slow revegetation would result in a long-term recovery rate. These impacts are significant (Figure 4.4-3).

MP 43.4-44.4, VRM/VQO: FS Class PR
This segment of the proposed route through the Manti-LaSal National Forest would create a moderate visual impact. The proposed route follows parts of Highway 89 and Skyline Drive, scenic routes through the National Forest, and is visible to motorists traveling on these local roads. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.4-3).

Table 4.4-8

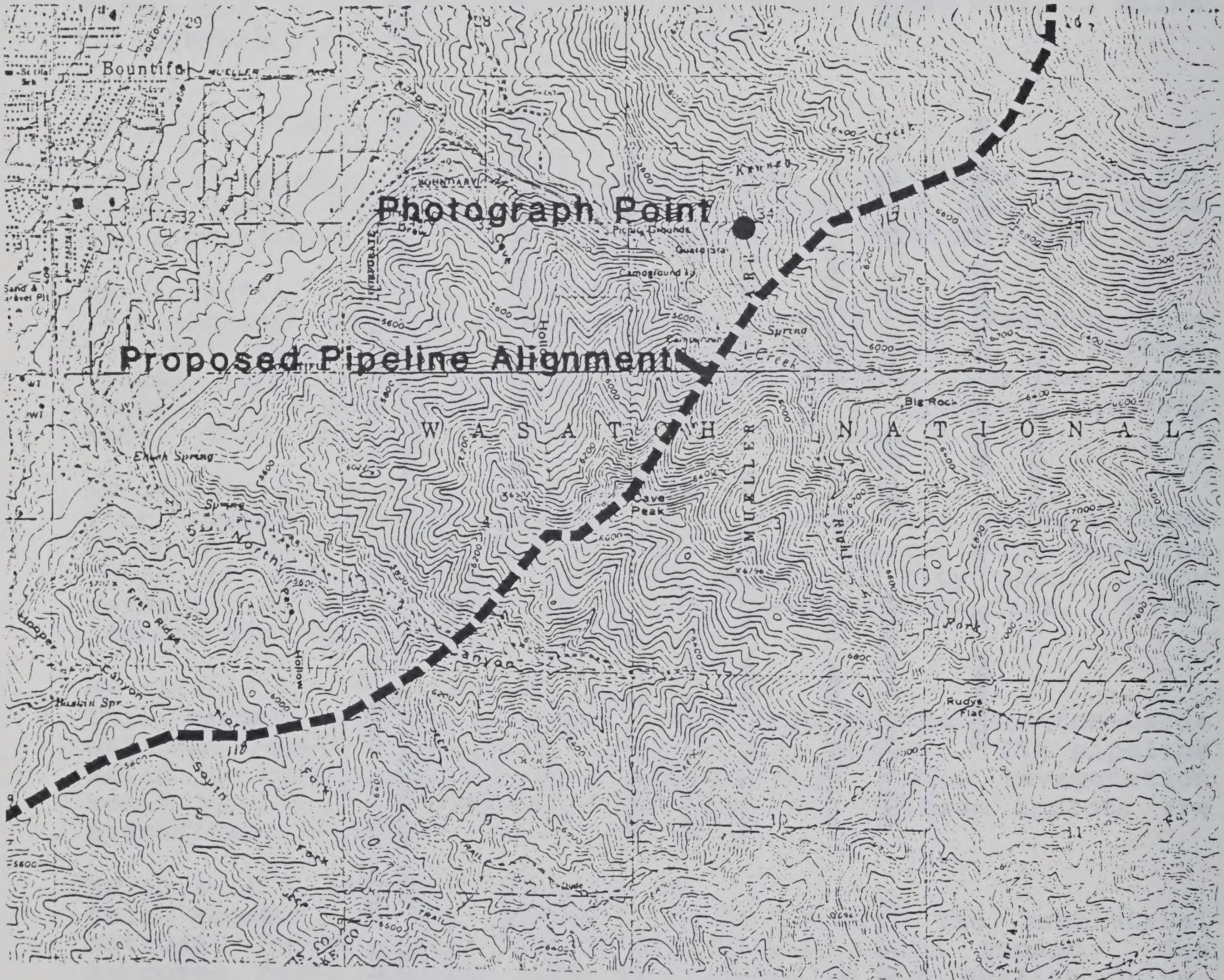
SUMMARY OF VISUAL IMPACTS, WASATCH VARIATION

Milepost	Jurisdiction	Affected Resource	VRM/VQO	Critical Viewpoint	Visual Impacts (Miles)		
					High [1]	Moderate [1]	Low
36.4-38.4	FS	Wasatch-Cache NF	PR	Mill Creek/local roads	-	-	2.0
36.9-40.2	FS	Wasatch-Cache NF	PR	Bountiful City area	0.3	-	-
41.4-43.4	FS	Wasatch-Cache NF	R	Mueller Park	2.0	-	-
43.4-44.4	FS	Manti-La Sal NF	PR	Skyline Drive and local roads	-	1.0	-
				TOTAL (Miles) OF VISUAL IMPACT	2.3	1.0	2.0

---

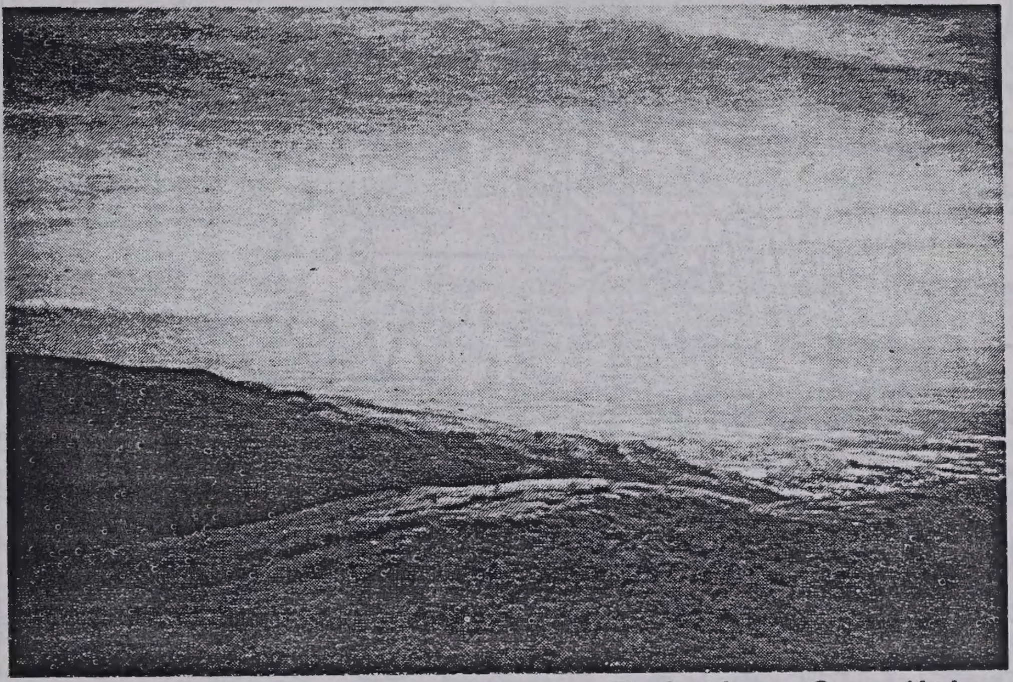
[1] Significant Impacts. The Wasatch-Cache National Forest has determined that approximately two miles of the variation on the National Forest might not maintain the established VQO.

Figure 4.4-1

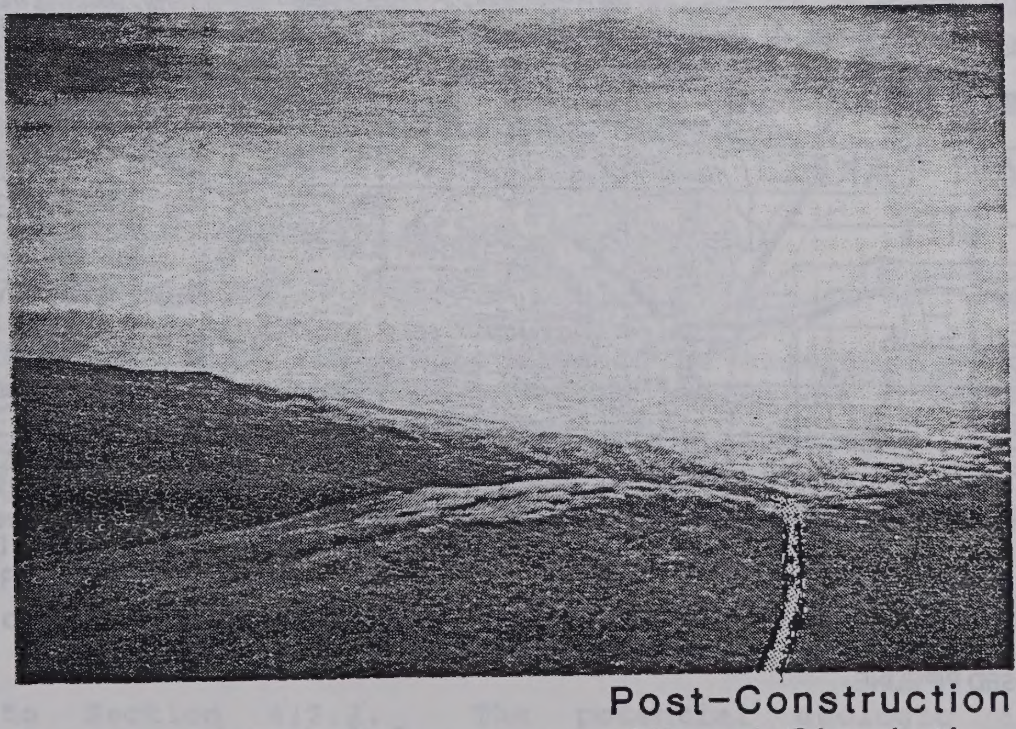

Bountiful
Photograph Point
Picnic Grounds
Campground
Proposed Pipeline Alignment
Spring Creek
Big Rock
W A S A T C H N A T I O N A L
Cave Peak
MUELLER PARK
Rudys Flat
North Fork
Canyon

KERN RIVER PROPOSAL
WASATCH RIDGE

Figure 4.4-2



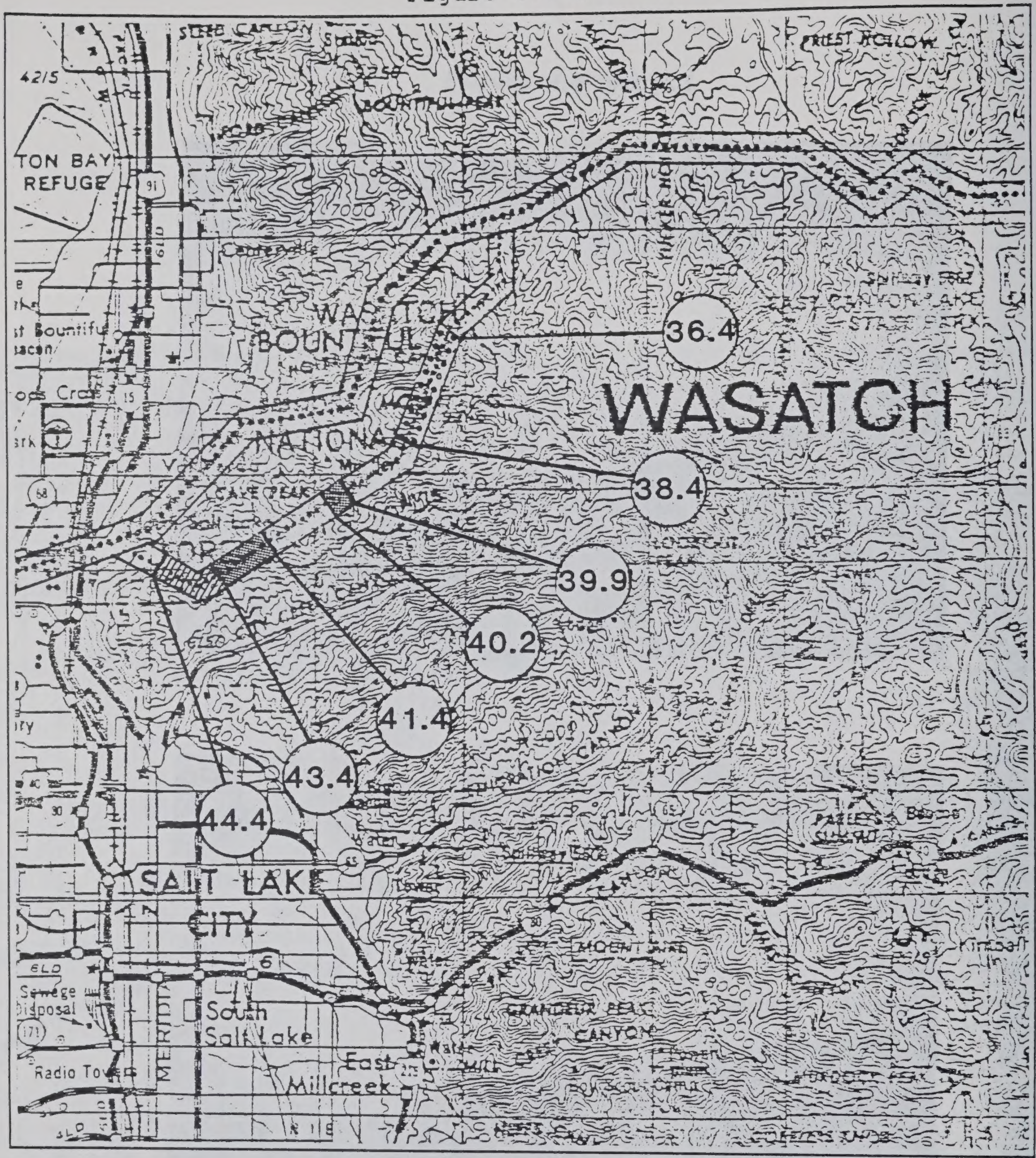
Existing Condition



Post-Construction
Visual Simulation

KERN RIVER PROPOSAL
WASATCH VARIATION
WASATCH RIDGE

Figure 4.4-3


WASATCH
NATIONAL
BOUNTIFUL
SALT LAKE
CITY
South
Salt Lake
East
Millcreek
36.4
38.4
39.9
40.2
41.4
43.4
44.4
TON BAY
REFUGE
PRIEST HOLLOW
MERIDIAN
Sewage
Disposal
Radio Tower
CANYON
8000
7000

LEGEND

- ■ PROPOSED COMPRESSOR STATION
- PROPOSED PIPELINE
- PROPOSED ALTERNATIVE PIPELINE
- 120 KR — PIPELINE MILEAGE (INTERVAL: 10 MILES)
- 120.5 — IMPACT MILEAGE
- ▨ HIGH IMPACT
- ▥ MODERATE IMPACT
- ⁘ LOW IMPACT

MOJAVE · KERN RIVER · EL DORADO
NATURAL GAS PIPELINE PROJECTS

KERN RIVER PROPOSAL

Scale (appx.)
0 .5 1 3
Miles

NORTH

SOURCE: WASATCH-CACHE NATIONAL FOREST
TAKATA ASSOCIATES

4.4.1.13 Systems Safety and Reliability

The Wasatch Variation would be approximately 20 miles longer than the primary route. Approximately 18 miles of the proposed route are currently under residential, commercial, and industrial development. The route would pass through this area in an existing electric transmission corridor. The route also would cross both existing gravel mining operations and areas where expanded gravel mining appears likely.

The first 43 miles of the Wasatch Variation is through remote rugged terrain with the potential for landslides and also crosses several known fault zones. The last 87 miles cross known active faults which have experienced high-intensity seismic activities in the recent past. Several areas may be prone to liquefaction. As stated above, approximately 18 miles of this section of the route pass through areas currently under development.

Maintenance and minor repairs to the pipeline may be dealyed as a result of seasonal access restrictions imposed by the Forest Service. Weather conditions, natural resource concerns, and management direction provided by approved Forest Plans will dictate when access to the pipeline will be permitted. There could be some effect on the schedule delivery of gas as a result of these restrictions.

The many and active geologic hazards along the variation will increase construction and maintenance costs. The pipeline will be susceptible to damage, causing inoperable conditions. Such damage and breaks in operations may occur at frequent intervals, due to geologic conditions and weather patterns.

4.4.2 West Strawberry Variation

4.4.2.1 Air Quality

Air quality emissions and impacts would be essentially the same as under the proposed primary route which was presented in Section 4.2.1. Total overall construction emissions would be slightly higher than those presented in Section 4.2.1 since this alternative is approximately two miles longer. Operation phase emissions and impacts would be identical to those in Section 4.2.1.

4.4.2.2 Geology

Refer to Section 4.2.2. The potential geologic impacts associated with the West Strawberry Variation include slope stability problems in the Twin Peaks (MP 21) and Brown Peak (MP 42) areas.

4.4.2.2.1 Seismicity and Faulting

No known Quaternary faults would be crossed. The nearby Strawberry Valley Fault could be a source of strong ground-shaking and potential liquefaction of susceptible soils.

4.4.2.2.2 Slope Stability

This route crosses rolling to very rugged terrain on the west side of the Middle Rocky Mountains where significant landslide activity had occurred during the past three years. The U.S. Forest Service has mapped numerous landslides in the area. These are large, deep-seated slides which, if crossed, could significantly affect the long-term stability of the pipeline. The potential for slope failures to occur and cause significant damage to the pipeline from MP 33-35 and from MP 40-44 is substantial. Above normal precipitation, rapid snowmelt and the geologic conditions along the west flank of the plateau led to the massive landslides and floods in 1983 which damaged many pipelines, roads, campgrounds, and other facilities. The wet trend and occurrence of new landslides have continued through the present time, resulting in a high potential for the continued occurrence of natural and induced landslides in these areas. The potential effects of slope stability problems associated with pipeline construction and long-term stability are addressed in Section 4.2.2.3.

4.4.2.2.3 Subsidence

Comments with respect to the proposed mainline in Section 4.2.2.4 also apply to the West Strawberry Variation.

4.4.2.2.4 Flash Floods and Debris Flows

Comments made with respect to the proposed mainline in Section 4.2.2.5 also apply to the West Strawberry Variation. The potential for flash flooding is high in the Tie Fork Canyon area, MP 22-28. Active erosion and scouring of alluvium occurs in the Tie Fork, Spanish Fork, Thistle Creek, and Water Hollow areas. Design and construction of the pipeline in these areas would require appropriate consideration to reduce the potential for pipeline erosion and exposure.

4.4.2.2.5 Avalanches

Comments dealing with the potential impacts of avalanches in Section 4.2.2.7 are pertinent.

4.4.2.2.6 Mineral/Petroleum Resources

The West Strawberry Variation route would not cross any known active or inactive mines or oil and gas fields.

4.4.2.3 Soil

Refer to Section 4.2.3 for a general discussion on impacts that could occur to soils due to pipeline construction, criteria used to delineate significant impacts, as well as a general description of methodology used to assess impacts. The distribution of potential soils impacts is summarized in Table 4.4-9.

The probability for significant water erosion along this route within the Middle Rocky Mountains (MP 0-63) is evenly distributed from low to high, with the high potential occurring on steep mountain slopes. The probability for significant wind erosion is mostly low. Reclamation potential is dominantly fair and poor, indicating that a sizeable portion of the route would have significant revegetation problems.

4.4.2.4 Surface Water

Approximately 16 perennial streams would be crossed by the pipeline within this region. These streams predominantly have moderate to high sensitivities relative to both channel and topographic sideslope gradients. Thus, the potential for significant impact as a result of pipeline construction, operation, and abandonment would be high. The steep terrain that the pipeline would traverse greatly increases the potential for significant impacts that would occur due to the steep slopes as previously described in Section 4.2.4.1.2. No source of water for use in the hydrostatic testing of the pipeline within this region has been itemized. Impacts associated with withdrawal and discharge of the water used in hydrostatic testing were previously described in Section 4.2.4, Volume I.

The pipeline variation would be located within a floodplain for the total length of the Tie Fork drainage, MP 26-28. Significant impacts to surface water would occur, due to the narrow confines of the canyon, steep sideslopes, and meandering nature of Tie Fork Creek. Pipeline construction activities would change the existing natural conditions in this drainage. There would be a loss of most of the riparian vegetation and the existing stream channel would have to be modified/rechanneled. The integrity of the pipeline itself would be difficult to maintain, due to extreme cutting of the stream through highly erosive alluvium in a narrow canyon area.

Table 4.4-9

DISTRIBUTION OF POTENTIAL SOILS IMPACTS, WEST STRAWBERRY VARIATION

		Erosion Potential [1]						Reclamation Potential [2] (miles) [3]		
		Water (miles) [3]			Wind (miles) [3]					
Milepost	Geographic Area	L	M	H	L	M	H	G	F	P
0.0-64.0	Middle Rocky Mtns	21.6	21.2	21.2	59.6	4.4	0.0	11.2	34.6	18.2

---

[1] Water Erosion Potential
L(low) = less than 5 tons/acre/year (low probability for significant erosion impacts).
M(moderate) = 5 to 20 tons/acre/year (near even probability for significant erosion impacts).
H(high) = greater than 20 tons/acre/year (high probability for significant erosion impacts).

Wind Erosion Potential
L(low) = low probability for significant erosion impact.
M(moderate) = near even probability for significant erosion impacts. Impact potential also dependent upon site specific exposure to prevailing winds.
H(high) = high probability for significant erosion impacts. Impact potential also dependent upon site specific exposure to prevailing winds.

[2] Reclamation Potential
Ratings are based upon trenching with no selective soil handling or other mitigation.
G(good) = good probability for restoring vegetation which will support pre-existing land use. Productivity potential may be somewhat reduced.
F(fair) = near even probability for restoring vegetation which will support pre-existing land use within short periods of time. Time needed for re-establishment is likely to be longer than soils with good potential. Productivity potential may be reduced.
P(poor) = low probability for restoring vegetation which will support pre-existing land use within a short period of time. Time needed for re-establishment is likely to be long. Productivity potential may be reduced.

[3] Cumulative miles for pipeline segment.

4.4.2.5 Groundwater

General impacts to the groundwater resources that could occur as a result of pipeline construction are given in Section 4.2.5. No significant impact to groundwater resources is anticipated.

4.4.2.6 Freshwater Biology

Impacts of construction of this route on streams that would be traversed or closely adjacent to the West Strawberry Variation are presented in Table 4.4-10. Ten streams with fishery resources, all within the Middle Rocky Mountains region, would be crossed or are adjacent to the pipeline. Two streams, Bryant's Fork and Tie Fork, would be significantly impacted by construction activities, as both are crossed by the pipeline multiple times and are considered Class B streams. In addition, the streams exhibit a high potential for impact due to sedimentation as a result of steep gradient and sideslopes in the vicinity of the crossings. Two drainages within this region support a federal candidate species, the leatherside chub. No significant impacts are expected to occur to this species as the drainages in which it occurs have low sedimentation potential.

Table 4.4-10

SIGNIFICANCE OF IMPACTS ON AQUATIC COMMUNITIES,
WEST STRAWBERRY VARIATION

Utah County	Stream	Approximate Milepost	Impacts 1/
Middle Rocky Mountains (MP 0-64)			
Wasatch	Strawberry River	0.2	NS
	Strawberry River	5.3	NS
	Clyde Creek	7.5	NS
	Mud Creek	9.2	NS
	Bryant's Fork	10.7	S
	Bryant's Fork	10.8	S
	Horse Creek	13.2	NS
	Squaw Creek	14.3	NS
	Crooked Creek	16.2	NS
	Indian Creek	16.2	NS
	Tie Fork	26-28	S
Utah	Soldier Creek	28.2	NS
Sanpete	Thistle Creek	44.8	NS

1/ NS - not significant
S - significant

4.4.2.7 Terrestrial Biology

4.4.2.7.1 Vegetation

General Vegetation. Approximately 780 acres of vegetation would be denuded by the construction of the proposed West Strawberry Variation. Table 4.4-11 lists the vegetation types and acreage of each type that would be denuded during construction. No Class I impact would occur as a result of constructing this variation. Approximately 410 acres of Class II impact would occur including 35 acres of agricultural land, 105 acres of wetland/riparian a major portion of which would occur along Strawberry River and Tie Fork canyon, and 270 acres of montane forest.

Plant Species of Special Concern. One federally listed endangered species, clay phacelia, and three candidate species are known to occur in the vicinity of the pipeline route. Field surveys were conducted for clay phacelia along a portion of the proposed variation. No individuals were found in or adjacent to the estimated location of the ROW. Approximately one acre of suitable habitat was identified adjacent to the estimated ROW. The species could be significantly impacted (Class II) through loss of habitat due to activities associated with pipeline construction.

4.4.2.7.2 Wildlife

Criteria used to determine significance of impacts and general impacts associated with construction of the proposed West Strawberry Variation are the same as those described for the Kern River mainline (Section 4.2.7.2). Significant impacts to general wildlife are identified and tabulated in Table 4.4-12.

General Wildlife. Critical and high priority winter range for elk and mule deer would be traversed by the West Strawberry Variation. In addition, two critical elk calving areas would be disturbed by the proposed pipeline. Disturbance during winter or during elk calving would be a Class II impact. Loss of critical winter range and calving habitat would also be a Class II impact.

The area immediately west of Strawberry Reservoir is considered a high priority sage grouse nesting area by the State of Utah [Nelson, 1986]. Construction during grouse nesting would result in the loss of an indeterminate number of nests and birds, significantly impacting the local population (Class II impact). Loss of nesting habitat would also be a Class II impact.

Many raptors nest in the general vicinity of the proposed corridor, especially in the area west of the Strawberry Reservoir. Disturbance to raptors during nesting could result in nest abandonment, a Class II impact.

Table 4.4-11
VEGETATION TYPES AND DENUDED ACREAGES, WEST STRAWBERRY VARIATION

Geographic Region	Vegetation Type	Impact Class [2]	Denudation [1] (acres) Short Term[3]	Long Term[4]	Permanent[5]	Total
Middle Rocky Mountains	Montane forest	II	133.3	133.3	0	266.6
	Sagebrush scrub	III	60.6	0	0	60.6
	Pinyon-Juniper woodland	III	81.8	81.8	0	163.6
	Mountain brush	III	69.7	69.7	0	139.4
	Agricultural lands	II	36.4	0	0	36.4
	Wetland/riparian	II	109.1	0	0	109.1
		TOTAL	490.9	284.8	0	775.7
SUMMARY BY IMPACT CLASS [2]						
	Class	I	0	0	0	0
	Class	II	278.8	133.3	0	412.1
	Class	III	212.1	151.5	0	363.6
	Class	IV	0	0	0	0
		TOTAL	490.9	284.8	0	775.7

---

[1] vegetation loss assuming a 100-foot wide construction ROW and a 50-foot wide operational ROW.

[2] see section 4.2.7.1 for definitions of impact classes.

[3] short term loss = vegetation loss within community types with fair or better revegetation potential; vegetation loss within total 100-foot wide construction ROW if large woody shrubs or trees not present; vegetation loss short term within the 50-foot wide portion of the construction ROW not used for operation with large woody shrubs and trees present; vegetation loss would not be significant.

[4] long term loss = loss of vegetation within community types with fair or better revegetation potential containing large woody shrubs or trees present in operational ROW (50-foot wide) which would hamper operations and, therefore, would not be allowed to re-establish in the operational ROW during the life of the project; vegetation loss would not be significant.

[5] permanent loss = loss of vegetation within community types with poor or worse revegetation potential; vegetation loss would be significant.

Table 4.4-12

SIGNIFICANT WILDLIFE IMPACTS, WEST STRAWBERRY VARIATION

	Wildlife groups and life requisites impacted [1]				
Milepost or feature	Wintering [2] big game	Migrating [2] big game	Calving/fawning [2] big game	Nesting/breeding sage grouse	Nesting raptors
0-20	MD	-	E	x [3]	5 nests
21-40	MD,E	-	E	-	-
41-63 (end)	MD,E	-	-	E	-

---

[1] Impacts are delineated by species, where possible, and include both habitat and population related impacts unless specifically stated in the table.

[2] Big game species include mule deer (MD), elk (E), moose (M) and pronghorn (P).

[3] An "x" signifies that an impact occurs within the milepost designation.

Wildlife Species of Special Concern. Swainson's hawk nests have been identified along the proposed pipeline corridor. Construction activities during the nesting season could result in nest abandonment and would be a Class II impact.

4.4.2.7.3 Grazing

Criteria used to evaluate potential impacts to grazing along this proposed route variations are the same as those listed in Section 4.2.7.3.

The proposed route variation involves less than one percent of any allotment that would be traversed or traverse private lands (Appendix C); therefore, no significant impacts to grazing would occur.

4.4.2.8 Socioeconomics

4.4.2.8.1 Population, Housing, and Economic Impacts

This variation is approximately the same length as the proposed project and compressor station needs will be the same. Therefore, the anticipated impacts are approximately the same as the proposed project.

4.4.2.8.2 Traffic

Those areas on the Uinta NF which have no access from major highways, or access is by Forest roads to the route of the variation would be adversely impacted by the construction of new roads. Existing Forest roads that would be used for pipeline construction activities would require reconstruction to heavy haul standards. New road construction and reconstruction of existing roads may not be permitted, depending on terrain and natural resource conditions and values. On existing roads used, there would be increased traffic, with resulting safety and maintenance concerns. For new road construction, there would be new disturbance to soil, water, and wildlife resources and possible entry into previously unroaded areas.

New roads placed in Semiprimitive Nonmotorized areas would also compromise Recreation Opportunity objectives. This would be a significant impact.

Traffic volumes are moderate to high during summer months on roads leading to the Strawberry Recreation complex. Some delays and/or detours may occur during construction, particularly on Fridays and Mondays when weekend visitors are arriving and departing the area. Delays and/or detours may also occur under the same conditions along Skyline Drive in the Manti-LaSal NF. These would be short-term impacts.

4.4.2.8.3 Noise

Pipeline construction along the route variation would cause the same type of impacts as those discussed in Section 4.2.8.3. Increased noise levels would be short-term and the temporary noise increases would be of greater impact where construction occurs in or adjacent to residential areas. Due to the temporary nature of pipeline construction, noise will not be considered a significant impact along this variation.

4.4.2.8.4 Recreational Resources

The pipeline route would be adjacent to the Bryants Fork Summer Home Area and through portions of the Strawberry Recreation Area on the Uinta National Forest. There would be temporary impacts to recreation users/uses in these areas during construction of the variation. Increased traffic, noise, and fugitive dust would be evident along the west shore of the Reservoir. The mix of construction and recreation would create safety hazards. Because of the long distance via paved roads between the construction within the first 30 mile segment of this variation and the supply of motel rooms and RV spaces in the communities in the Jordan/Juab Valley, construction workers may seek campsites on Forest Service and private lands near the Strawberry Reservoir. Summer visitation is high, 40,000 on a typical weekend.

Long-term impacts are expected to recreation management of off-road vehicle use. It has been difficult for the Forest Service to keep vehicles off linear ROWs, especially pipeline routes. Resource damage would be expected along the pipeline route from off-road vehicle use.

Skyline Drive, south of Spanish Fork Valley, is a popular scenic drive across the Manti-LaSal NF. Although there would be short-term impacts in terms of incrased traffic volumes, there could also be a long-term enhancement of recreation opportunities by upgrading a portion of Skyline Drive.

Five miles (between MP 16-19 and 20-22) of Semiprimitive Nonmotorized areas of Uinta NF land would be significantly impacted due to the availability of the ROW to off-road vehicles. The Recreation Opportunity objective on Manti-LaSal NF lands is Roaded Natural; this objective would not be compromised.

4.4.2.9 Land Ownership/Use

The West Strawberry Variation is not within an existing utility corridor where it traverses the Uinta and Manti-LaSal National Forests. It is within an avoidance area on the Manti-LaSal NF. This constitutes a significant impact. Refer to Appendix F for a detailed discussion of Forest Plans. Refer to Table 4.4-13 for construction and operation disturbance for the variation by land ownership. Table 4.4-14 shows the number of acres that would be disturbed by land use.

Table 4.4-13

CONSTRUCTION AND OPERATION DISTURBANCE BY LAND OWNERSHIP, WEST STRAWBERRY VARIATION

State, County	Disturbance Area	Total Acres	Private Acres	BLM Acres	FS Acres
UTAH					
Wasatch	100' Construction	272.2	104.2	-	168.5
	50' Operation	136.4	52.1	-	84.2
Utah	100' Construction	275.2	38.8	-	236.4
	50' Operation	137.6	19.4	-	118.2
Sanpete	100' Construction	227.9	206.1	21.8	-
	50' Operation	113.9	103.0	10.9	-
Total	100' Construction	775.8	349.1	21.8	404.8
	50' Operation	387.9	174.5	10.9	202.4

Table 4.4-14

CONSTRUCTION AND OPERATION DISTURBANCE BY LAND USE, WEST STRAWBERRY VARIATION

State, County	Disturbance Area	Total Acres	Grazing/ Rangeland Acres	Timber/ Forest Acres	Irrigated/ Non-Irrigated Agriculture Acres
UTAH					
Wasatch	100' Construction	272.7	92.1	168.5	12.1
	50' Operation	136.4	46.1	84.2	6.1
Utah	100' Construction	275.2	38.8	236.4	-
	50' Operation	137.6	19.4	118.2	-
Sanpete	100' Construction	227.9	227.9	-	-
	50' Operation	113.9	113.9	-	-
Total	100' Construction	775.8	358.8	404.8	12.1
	50' Operation	387.9	179.4	202.4	6.1

4.4.2.10 Cultural Resources

4.4.2.10.1 Archaeology

Direct Impacts. One known site, a lithic scatter, is located in the zone of direct impact. There is also an historic trail whose location is not precisely known with reference to the analysis corridor but which may pass through the zone of direct impact. Only 0.4 percent of the direct impact zone has been surveyed.

Indirect Impacts. A historic military target range and associated trail, and a lithic scatter fall within the zone of indirect impact.

4.4.2.10.2 American Indian Concerns

The Ute Indian Tribe of Utah is concerned about impacts to ancestral (archaeological) sites listed above. See also Section 4.2.10.2.

4.4.2.11 Paleontological Resources

The West Strawberry Variation would impact 49.7 miles of significant formations, 0.5 mile of formations with an undetermined significance and 13.8 miles of formations which are not significant.

4.4.2.12 Visual Resources

Refer to Section 4.2.12 for methodology. Refer to Table 4.4-15 for a summary of visual impacts.

MP 4.8-5.0, VRM/VQO: FS Class PR
This segment of the proposed route through the Uinta National Forest would create a high visual impact. The proposed route crosses steep foothills and parallels an unimproved road. The pipeline would be visible from Highway 40. Slow vegetative rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.4-4).

MP 5.5-8.0, VRM/VQO: FS Class PR
This segment of the proposed route through the Uinta National Forest crosses Clyde Creek and follows existing utility lines; it would create a moderate visual impact. The pipeline is highly visible from reservoir access roads, Strawberry Reservoir, and Highway 40. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.4-4).

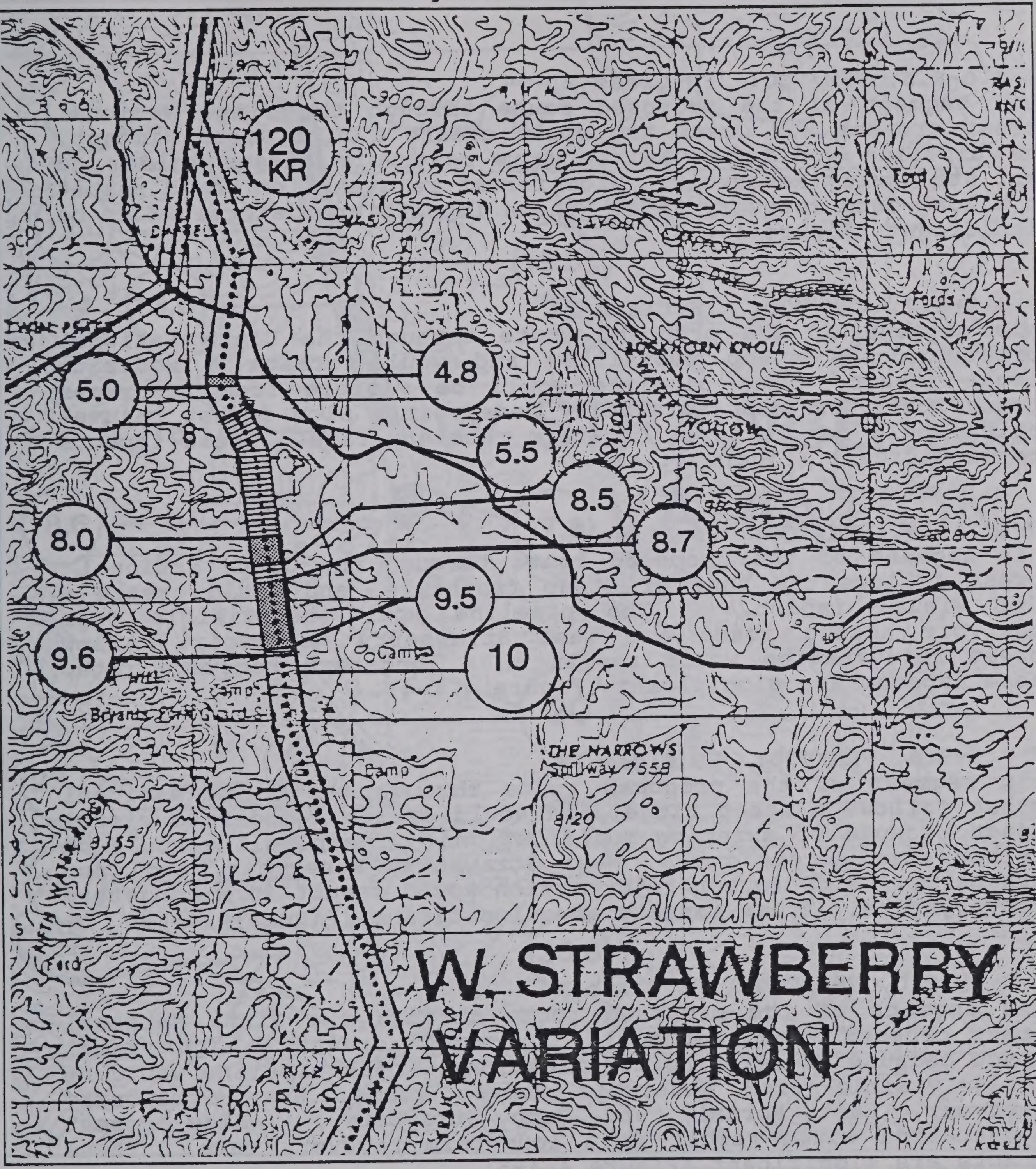
Table 4.4-15

SUMMARY OF VISUAL IMPACTS, WEST STRAWBERRY VARIATION

					Visual Impacts (Miles)			
Milepost	Jurisdiction	Affected Resource	VQO	Critical Viewpoint	High[1/]	Moderate[1/]	Low	Vac
4.8-5.0	FS	Uinta NF	PR	Highway 40	0.2	-	-	M
5.5-8.0	FS	Uinta NF	PR	Hwy 40, Local Rd, Reservoir	-	2.5	-	M&H
8.0-8.5	FS	Uinta NF	R	West Strawberry Reservoir	0.5	-	-	M
8.5-8.7	FS	Uinta NF	PR	West Strawberry Reservoir	-	0.2	-	H
8.7-9.5	FS	Uinta NF	R	West Strawberry Reservoir	0.8	-	-	M&H
9.5-9.6	FS	Uinta NF	PR	West Strawberry Reservoir	-	0.1	-	H
9.6-12.0	FS	Uinta NF	R	West Strawberry Reservoir	2.4	-	-	M
12.0-12.8	FS	Uinta NF	PR	West Strawberry Reservoir	0.8	-	-	M
13.6-16.1	FS	Uinta NF	PR	Indian Creek Road	2.5	-	-	M
17.8-18.6	FS	Uinta NF	PR	Indian Creek Road	0.8	-	-	H
23.2-23.7	FS	Uinta NF	PR	Hwy 6 and 50	-	0.5	-	M
23.8-24.7	FS	Uinta NF	PR	Hwy 6 and 50	-	0.9	-	M&H
29.1-43.2	FS	Manti-La Sal NF	PR	Hwy 89, Skyline Dr.	-	14.1	-	
			TOTAL (Miles) OF VISUAL IMPACT		8.0	18.3	0.0	

[1/] Significant Impacts. The Uinta National Forest has determined that approximately 16 miles of the variation on Forest lands would not maintain the established VQO.

Figure 4.4-4


120 KR
5.0
4.8
5.5
8.5
8.0
8.7
9.5
9.6
10
W. STRAWBERRY VARIATION
THE NARROWS
Spillway 7558
BUCKHORN KNOLL
Camp
Bryants Fk G.S.
F O R E S
NORTH WATER RIDGE
9000
8120
9155

LEGEND

■ PROPOSED COMPRESSOR STATION

═ PROPOSED PIPELINE

▭ PROPOSED ALTERNATIVE PIPELINE

(120 KR) PIPELINE MILEAGE (INTERVAL: 10 MILES)

(120.5) IMPACT MILEAGE

▨ HIGH IMPACT

▥ MODERATE IMPACT

⁘ LOW IMPACT

MOJAVE · KERN RIVER · EL DORADO
NATURAL GAS PIPELINE PROJECTS

KERN RIVER PROPOSAL

NORTH ⊕

Scale (appx.)
0 .5 1 3
Miles

SOURCE: UINTA NATIONAL FOREST
TAKATA ASSOCIATES

MP 8.0-8.5, VRM/VQO: FS Class R
This segment of the proposed route through the Uinta National Forest crosses Mud Creek and would create a high visual impact. The pipeline would be visible from reservoir access roads and West Strawberry Reservoir. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are determined to be significant (Figure 4.4-4).

MP 8.5-8.7, VRM/VQO: FS Class PR
This segment of the proposed route through the Uinta National Forest crosses steep foothills, and would create a moderate visual impact. The pipeline would be visible from reservoir access roads and West Strawberry Reservoir. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.4-4).

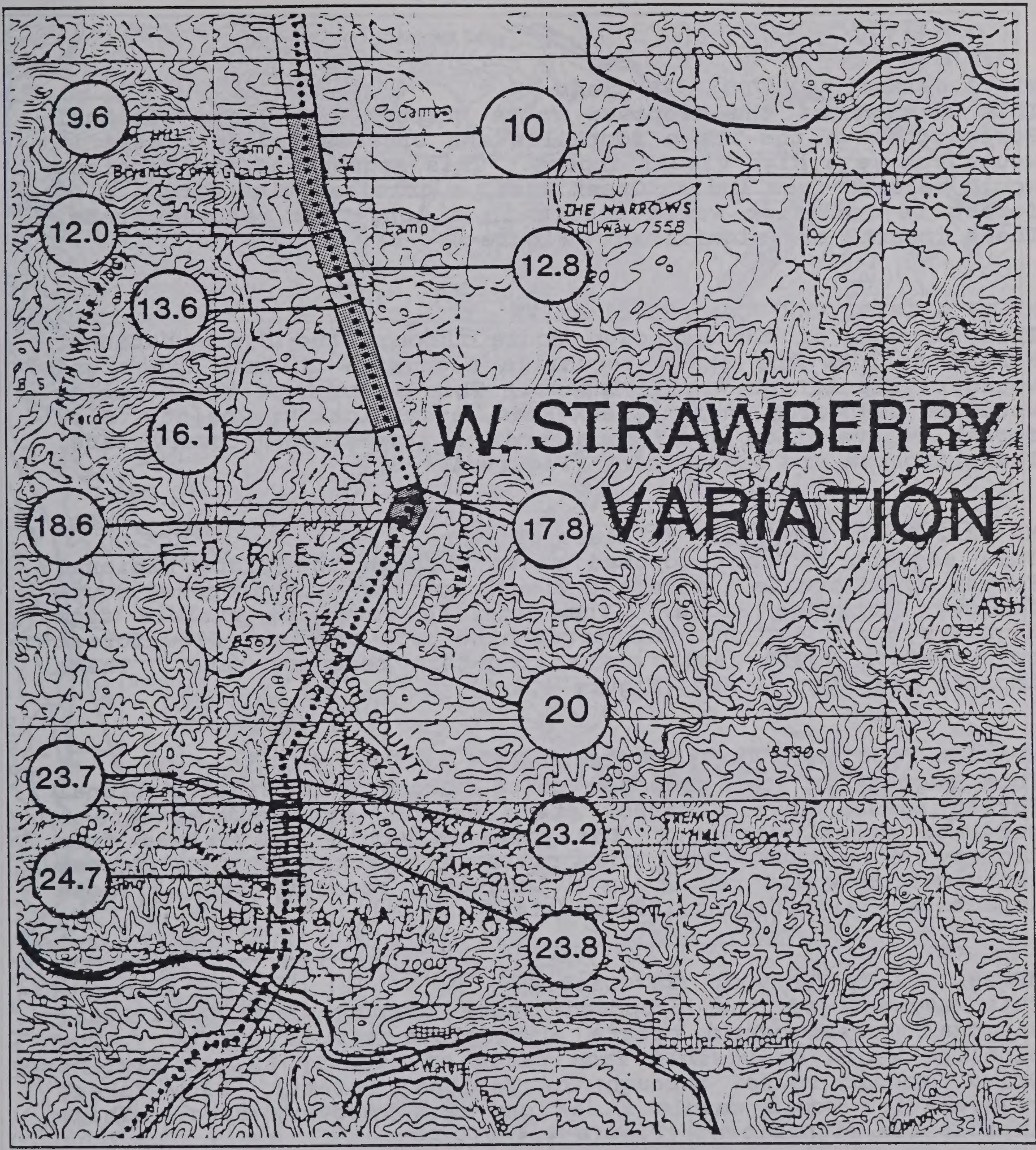
MP 8.7-9.5, VRM/VQO: FS Class R
This segment of the proposed route through the Uinta National Forest follows the base of steep foothills, and would create a high visual impact. The pipeline would be visible from reservoir access roads and West Strawberry Reservoir. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.4-4).

MP 9.5-9.6, VRM/VQO: FS Class PR
This segment of the proposed route through the Uinta National Forest follows a steep ridge, and would create a moderate visual impact because of existing modifications. The pipeline would be visible from access roads, West Strawberry Reservoir, and Camp Strawberry. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.4-4).

MP 9.6-12.0, VRM/VQO: FS Class R
This segment of the proposed route through the Uinta National Forest crosses steep foothills, and would create a high visual impact because of existing modifications. The pipeline would be highly visible from Reservoir access roads, West Strawberry Reservoir, East Portal, and Camp Strawberry. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.4-5).

MP 12.0-12.8, VRM/VQO: FS Class PR
This segment of the proposed route through the Uinta National Forest would create a high visual impact. The proposed route passes a low peak, crosses Horse Creek and Reservoir access. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.4-5).

Figure 4.4-5


9.6
10
12.0
12.8
13.6
16.1
18.6
17.8
20
23.7
23.2
24.7
23.8
W. STRAWBERRY
VARIATION
Camp
Camp
Camp
THE NARROWS
Spillway 7558
FOREST
8567
8530
WASATCH COUNTY
UINTA NATIONAL
Soldier Springs
Water
ASH

LEGEND

■ PROPOSED COMPRESSOR STATION

PROPOSED PIPELINE

PROPOSED ALTERNATIVE PIPELINE

(120 KR) PIPELINE MILEAGE (INTERVAL: 10 MILES)

(120.5) IMPACT MILEAGE

▩ HIGH IMPACT

▤ MODERATE IMPACT

⁙ LOW IMPACT

MOJAVE · KERN RIVER · EL DORADO
NATURAL GAS PIPELINE PROJECTS

KERN RIVER PROPOSAL

NORTH ⊕

Scale (appx.)
0 .5 1 3
Miles

SOURCE: UINTA NATIONAL FOREST
TAKATA ASSOCIATES

MP 13.6-16.1, VRM/VQO: FS Class PR

This segment of the proposed route through the Uinta National Forest follows the steep foothills and crosses Indian Creek; it would create a high visual impact. This segment of the pipeline would be seen from Indian Creek Road, a critical viewpoint. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.4-5).

MP 17.8-18.6, VRM/VQO: FS Class PR

This segment of the proposed route through the Uinta National Forest follows the steep foothills alongside Chipman Creek and would create a high visual impact. This segment of the pipeline would be seen from Indian Creek Road, a critical viewpoint. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.4-5).

MP 23.2-23.7, VRM/VQO: FS Class PR

This segment of the proposed route through the Uinta National Forest would create a moderate visual impact. The proposed route follows Partridge Ridge. The pipeline would be visible from Highways 6 and 50, and designated hike/pack trails. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.4-5).

MP 23.8-24.7, VRM/VQO: FS Class PR

This segment of the proposed route through the Uinta National Forest passes down a narrow steep canyon, and would create a moderate visual impact. The pipeline would be visible from Highway 6 and 50 and the railroad tracks. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.4-5).

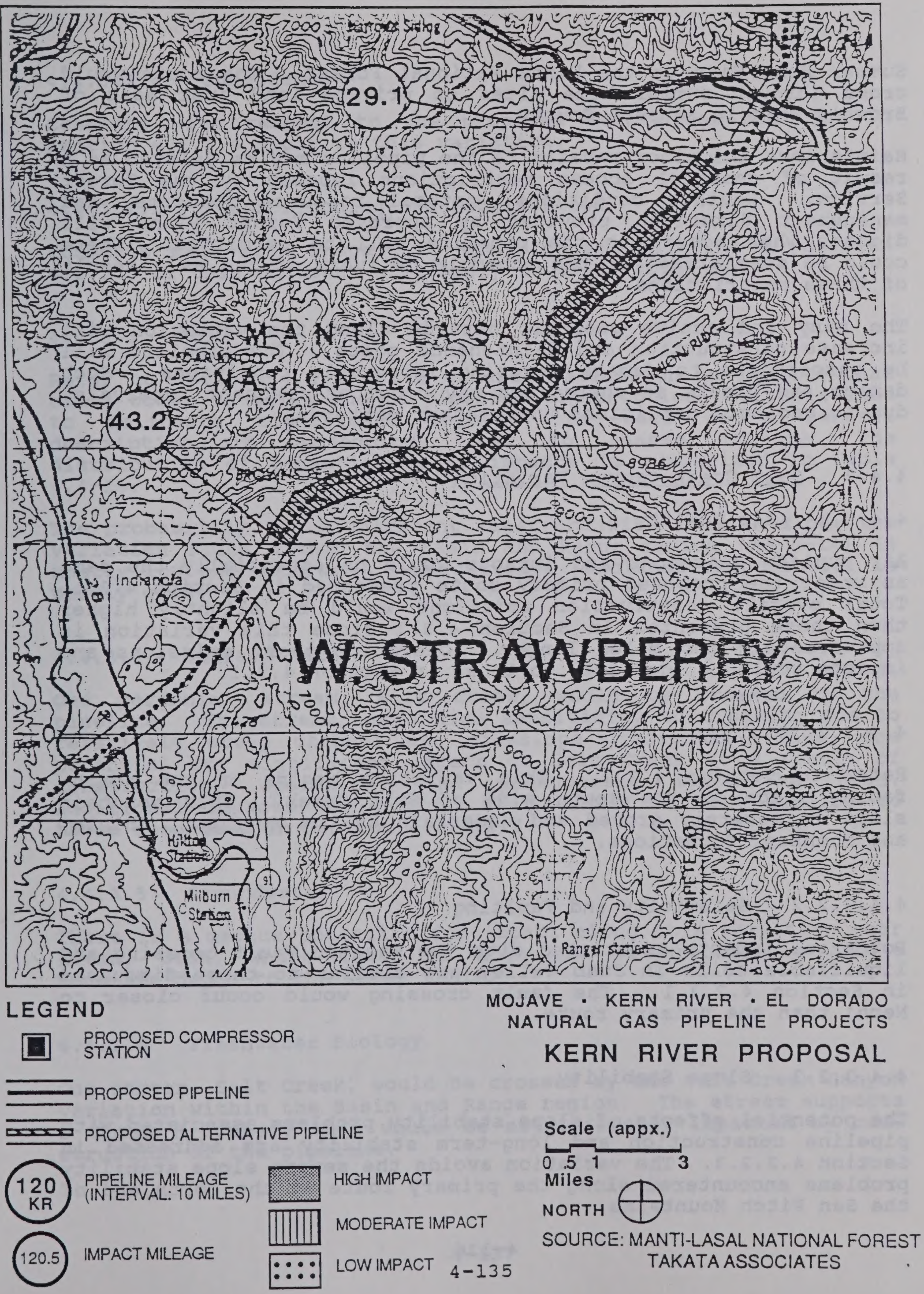
MP 29.1-43.2, VRM/VQO: FS Class PR

This segment of the proposed route through the Manti-LaSal National Forest would create a moderate visual impact. The pipeline would be visible from parts of Highway 89 and Skyline Drive, scenic routes through the National Forest. Slow forest rejuvenation would result in a long-term recovery rate. These impacts are significant (Figure 4.4-6).

4.4.2.13 System Safety and Reliability

The West Strawberry Variation would be approximately two miles longer than the primary route. The area is remote and rugged with no residences or populated areas located long the route. The area is seismically active and there are areas with landslide potential which could cause the pipeline to rupture. There are two summer home resident areas along this variation. The route would cross within 400 feet of 36 homes in the Bryants Fork

Figure 4.4-6


29.1
Mill Fork
7000
6000
MANTI-LASAL
NATIONAL FOREST
43.2
Clear Creek Ridge
Bennion Ridge
8986
9000
UTAH CO
Fish Creek
Indianola
W. STRAWBERRY
9148
9000
Wood Canyon
Hilltop Station
91
Milburn Station
Ranger station
SANPETE CO
LEGEND
PROPOSED COMPRESSOR STATION
PROPOSED PIPELINE
PROPOSED ALTERNATIVE PIPELINE
120 KR
PIPELINE MILEAGE (INTERVAL: 10 MILES)
120.5
IMPACT MILEAGE
HIGH IMPACT
MODERATE IMPACT
LOW IMPACT
Scale (appx.)
0 .5 1 3
Miles
NORTH

MOJAVE · KERN RIVER · EL DORADO
NATURAL GAS PIPELINE PROJECTS

KERN RIVER PROPOSAL

SOURCE: MANTI-LASAL NATIONAL FOREST
TAKATA ASSOCIATES

Summer Home Site on the Uinta National Forest. The route would cross through summer home sites on private land just east of Brown's Peak in Sanpete County.

Maintenance and minor repairs to the pipeline may be delayed as a result of seasonal access restrictions imposed by the Forest Service. Weather conditions, natural resource concerns, and management direction provided by approved Forest Plans will dictate when access to the pipeline will be permitted. There could be some affect on the schedule delivery of gas as a result of these restrictions.

The many and active geologic hazards along the variation will increase construction and maintenance costs. The pipeline will be susceptible to damage, causing inoperable conditions. Such damage and breaks in operations may occur at frequent intervals, due to geologic conditions and weather patterns.

4.4.3 Salt Creek Canyon Variation

4.4.3.1 Air Quality

Air quality emissions and impacts would be essentially the same as under the proposed primary route presented in Section 4.2.1. Total overall construction emissions would be slightly higher than those presented in Section 4.2.1 since this variation is approximately two miles longer. Operation phase emissions and impacts would be identical to those in Section 4.2.1.

4.4.3.2 Geology

Refer to Section 4.2.2. This variation begins on the north-facing slope on the south side of Salt Creek. This mountain slope is severely eroded and underlain by the Morrison, Chinle, and Moenkopi formations.

4.4.3.2.2 Seismicity and Faulting

Potential impacts associated with the Wasatch Fault crossing and liquifiable soils in Juab Valley are similar to those discussed in Section 4.2.2.1. The fault crossing would occur closer to Nephi than the primary route.

4.4.3.2.3 Slope Stability

The potential effects of slope stability problems associated with pipeline construction and long-term stability are addressed in Section 4.2.2.3. The variation avoids the severe slope stability problems encountered along the primary route at the north end of the San Pitch Mountains.

4.4.3.2.4 Subsidence

Comments with respect to the proposed Kern River mainline in Section 4.2.2.4 apply to this variation.

4.4.3.2.5 Flash Flooding and Debris Flows

Comments made with respect to the proposed mainline in Section 4.2.2.5 of this document also apply to this variation.

4.4.3.3 Soil

Refer to Section 4.2.3 for a general discussion on impacts that could occur to soils due to pipeline construction, ctiteria used to delineate significant impacts, as well as a general description of methodology used to assess impacts. The distribution of potential soils impacts is summarized in Table 4.4-16.

The probability for significant water and wind erosion along the variation route within the Basin and Range region (MP 0-14) is mostly low and moderate, respectively. Reclamation potential is mostly good.

4.4.3.4 Surface Water

One perennial stream, Salt Creek, would be crossed by the pipeline. The stream has a high sensitivity to crossing due to relatively steep channel and sideslope gradients. Thus, the potential for significant impact to Salt Creek as a result of construction, operation, and abandonment would be high. Additional impacts would occur which would be very similar to those described in Section 4.2.4.1.2.

4.4.3.5 Groundwater

There is a medium potential for impact along this variation near Levan, Utah, where there is high use of groundwater and a moderate depth to the water table.

4.4.3.6 Freshwater Biology

One stream, Salt Creek, would be crossed by the Salt Creek Canyon Variation within the Basin and Range region. The stream supports a Class B fishery that would be significantly impacted by construction of the pipeline.

Table 4.4-16

DISTRIBUTION OF POTENTIAL SOILS IMPACTS, SALT CREEK CANYON VARIATION

		Erosion Potential 1/						Reclamation Potential 2/ (miles) 3/		
		Water (miles) 3/			Wind (miles) 3/					
Milepost	Geographic Area	L	M	H	L	M	H	G	F	P
0.0-14.0	Basin and Range	12.7	1.3	0.0	1.4	12.6	0.0	12.9	1.1	0.0

1/Water Erosion Potential

L(low) = less than 5 tons/acre/year (low probability for significant erosion impacts).

M(moderate) = 5 to 20 tons/acre/year (near even probability for significant erosion impacts).

H(high) = greater than 20 tons/acre/year (high probability for significant erosion impacts).

Wind Erosion Potential

L(low) = low probability for significant erosion impact.

M(moderate) = near even probability for significant erosion impacts. Impact potential also dependent upon site specific exposure to prevailing winds.

H(high) = high probability for significant erosion impacts. Impact potential also dependent upon site specific exposure to prevailing winds.

2/Reclamation Potential

Ratings are based upon trenching with no selective soil handling or other mitigation.

G(good) = good probability for restoring vegetation which will support pre-existing land use. Productivity potential may be somewhat reduced.

F(fair) = near even probability for restoring vegetation which will support pre-existing land use within short periods of time. Time needed for re-establishment is likely to be longer than soils with good potential. Productivity potential may be reduced.

P(poor) = low probability for restoring vegetation which will support pre-existing land use within a short period of time. Time needed for re-establishment is likely to be long. Productivity potential may be reduced.

3/Cumulative miles for pipeline segment.

4.4.3.7 Terrestrial Biology

4.4.3.7.1 Vegetation

General Vegetation. Approximately 170 acres of vegetation would be denuded by construction of the proposed Salt Creek Canyon Variation. Of this area, 24 acres of mountain brush and 145 acres of agricultural land would be disturbed. Minor areas of riparian vegetation may also be disturbed. The loss of agricultural land and riparian vegetation would be significant Class II).

Plant Species of Special Concern. No plant species of concern are known to occur in the vicinity of this variation. Therefore, no significant impact is expected as a result of pipeline construction.

4.4.3.7.2 Wildlife

Criteria used to determine significance of impacts and general impacts associated with construction of the proposed Salt Creek Variation are the same as those described for the Kern River Mainline (Section 4.2.7.2). The presence of species of special interest along the proposed variation is presented in Table 3.2-5.

General Wildlife. Limited deer critical winter range would be traversed by the Salt Creek Canyon Variation. Disturbance during high stress periods would be a Class II impact. Three golden eagle nests have been identified in the foothills immediately east of Nephi, Utah. Disturbance during nesting would be a Class II impact.

Wildlife Species of Special Concern. No significant impacts would be expected to occur to species of special concern as a result of construction of the proposed pipeline.

4.4.3.7.3 Grazing

Criteria used to evaluate potential impacts to grazing along these proposed route variations are the same as those listed in Section 4.2.7.3.

The proposed route variation involves less than one percent of any allotment that would be traversed or traverse private lands (Appendix D); therefore, no significant impacts to grazing would occur.

4.4.3.8 Socioeconomics

4.4.3.8.1 Population, Housing, and Economic Impacts

The estimated socioeconomic impacts are expected to be similar to the proposed project.

4.4.3.8.2 Traffic

Minor temporary delays to traffic on State Road 41 may occur if the variation were employed, but are not expected since the paved road will be bored under.

4.4.3.8.3 Noise

Pipeline construction along the proposed route variation would cause the same types of impacts as those discussed in Section 4.2.8.3. Due to the temporary nature of pipeline construction, noise will not be considered a significant impact along this variation.

4.4.3.8.4 Recreational Resources

No impacts are anticipated on developed resources since none occur.

4.4.3.9 Land Ownership/Use

The only potential impact with the Salt Creek Canyon Variation is at the narrow mouth of the canyon where an existing rock quarry is located. There would be a long-term impact if the quarry could not be mined for the life of the project. Refer to Table 4.4-17 for construction and operation disturbance for this variation by land ownership. Table 4.4-18 shows the number of acres disturbed by land use.

Table 4.4-17

CONSTRUCTION AND OPERATION DISTURBANCE BY LAND OWNERSHIP, SALT CREEK CANYON VARIATION

County, State	Disturbance Area	Total Acres	Private Acres
Juab, UT	100' Construction	169.7	167.7
	50' Operation	84.8	84.8

Table 4.4-18

CONSTRUCTION AND OPERATION DISTURBANCE BY LAND USE,
SALT CREEK CANYON VARIATION

County, State	Disturbance Area	Total Acres	Grazing/ Rangeland Acres	Residential Acres	Other Acres
Juab,	100'Construction	169.7	139.4	6.1	24.2
UT	50' Operation	84.8	69.7	3.0	12.1

4.4.3.10 Cultural Resources

4.4.3.10.1 Archaeology

No surveys have been conducted along the proposed pipeline route.

Although no prehistoric resources have been documented, one or more petroglyph sites have been reported to be located just northeast of Nephi and within the mile-wide analysis corridor. It is possible that such sites lie within the zone of indirect impact.

A recent study in the historic town of Nephi revealed the presence of at least 610 historic structures. It is unlikely that any of these structures fall within the zone of direct impact, but it is possible that some may lie within the zone of indirect impact.

This short variation has been assigned a high sensitivity rating.

4.4.3.10.2 American Indian Concerns

For general concerns about impacts along the Kern River pipeline, see Section 4.2.10.2. There are no additional concerns to relate for this variation.

4.4.3.11 Paleontological Resources

The Salt Creek Canyon Variation would traverse 14.0 miles of formations which have been determined to be not significant.

4.4.3.13 System Safety and Reliability

The Salt Creek Canyon Variation is 2.3 miles longer than the primary route. This route passes within a half mile of Nephi and through an area of scattered residences in the Juab Valley.

4.4.4 North Las Vegas Variation with the Goodsprings Spur

4.4.4.1 Air Quality

Air quality emissions and impacts would be essentially the same as under the proposed primary route which was presented in Section 4.2.1. Total overall construction emissions would be slightly higher than those presented in Section 4.2.1 since this variation is approximately nine miles longer. Operation phase emissions and impacts would be identical to those in Section 4.2.1, although the location of impacts associated with Compressor Station No. 5 would be shifted.

4.4.4.2 Geology

Refer to Section 4.2.2.

4.4.4.2.1 Seismicity and Faulting

Potential impacts associated with fault crossings and soil liquefaction are similar to those discussed in Section 4.2.2.2. Near MP 282, the proposed route would cross the Las Vegas Shear Zone, a major right-lateral strike slip fault of suspected Quaternary age [Stewart and Carlson, 1978; Bell, 1981].

4.4.4.2.2 Slope Stability

This variation would cross through the Bird Spring Range where minor slope instabilities may exist, but are generally unlikely due to the arid climate. The potential effects of slope stability problems associated with pipeline construction and long-term stability are addressed in Section 4.2.2.3.

4.4.4.2.3 Subsidence

Comments with respect to the proposed Kern River mainline in Section 4.2.2.4 apply to the North Las Vegas Variation. Groundwater overdrafting has occurred in the Las Vegas Valley and has created subsidence in the past [Bell, 1981]; however, in the absence of ground fissuring, this type of subsidence is not considered to be a significant hazard to welded steel gas pipelines.

4.4.4.2.4 Flash Floods and Debris Flows

Comments made with respect to the proposed mainline through the Basin and Range region in Section 4.2.2.5 also apply to the North Las Vegas Variation.

4.4.4.2.7 Mineral/Petroleum Resources

No significant adverse impact to active or planned mineral or petroleum development would be expected to result from implementation of this variation.

4.4.4.3 Soil

Refer to Section 4.2.3 for a general discussion on impacts that could occur to soils due to pipeline construction, criteria used to delineate significant impacts, as well as a general description of methodology used to assess impacts. The distribution of potential soils impacts is summarized in Table 4.4-19.

The probability for significant water and wind erosion along the route of this proposed variation is mostly low and moderate. The dominantly poor reclamation potential indicates significant revegetation problems.

4.4.4.4 Surface Water

No perennial streams would be crossed by the pipeline. However, several major intermittent streams would be crossed including Weiser Wash, Meadow Valley Wash, and Muddy River. Impacts caused by pipeline construction, operation, and abandonment within the Mojave Desert were previously described in Section 4.2.4.1.4.

4.4.4.5 Groundwater

There is a low potential for significant groundwater impact where the route would cross Las Vegas Valley on the north side of Las Vegas where the water table is moderately deep and there is high use.

4.4.4.6 Freshwater Biology

One drainage that would be crossed by the proposed pipeline within this region is rated as a Class B stream due to the presence of a number of sensitive species, including the federally listed Moapa dace and two federal candidate species.

Conditionally, impacts resulting from construction of this crossing would not be significant since all three species are found primarily upstream of the proposed cossing; however, surveys for the Moapa roundtail chub and the Moapa White River springfish should be conducted in the vicinity of the crossing prior to construction to ascertain whether or not these species are present. If populations are located at or near the proposed crossing, special measures may be required for their preservation.

Table 4.4-19

DISTRIBUTION OF POTENTIAL SOILS IMPACTS, NORTH LAS VEGAS VARIATION

		Erosion Potential 1/						Reclamation Potential 2/ (miles) 3/		
		Water (miles) 3/			Wind (miles) 3/					
Milepost	Geographic Area	L	M	H	L	M	H	G	F	P
0.0-109.0	Mojave Desert	97.2	9.8	2.0	60.2	41.8	7.0	0.6	6.9	101.5

1/Water Erosion Potential
L(low) = less than 5 tons/acre/year (low probability for significant erosion impacts).
M(moderate) = 5 to 20 tons/acre/year (near even probability for significant erosion impacts).
H(high) = greater than 20 tons/acre/year (high probability for significant erosion impacts).

Wind Erosion Potential
L(low) = low probability for significant erosion impact.
M(moderate) = near even probability for significant erosion impacts. Impact potential also dependent upon site specific exposure to prevailing winds.
H(high) = high probability for significant erosion impacts. Impact potential also dependent upon site specific exposure to prevailing winds.

2/Reclamation Potential
Ratings are based upon trenching with no selective soil handling or other mitigation.
G(good) = good probability for restoring vegetation which will support pre-existing land use. Productivity potential may be somewhat reduced.
F(fair) = near even probability for restoring vegetation which will support pre-existing land use within short periods of time. Time needed for re-establishment is likely to be longer than soils with good potential. Productivity potential may be reduced.
P(poor) = low probability for restoring vegetation which will support pre-existing land use within a short period of time. Time needed for re-establishment is likely to be long. Productivity potential may be reduced.

3/Cumulative miles for pipeline segment.

4.4.4.7 Terrestrial Biology

4.4.4.7.1 Vegetation

General Vegetation. Approximately 1,320 acres of vegetation would be denuded by construction of the proposed North Las Vegas Variation as indicated in Table 4.4-20. Of this total, approximately 1,310 acres of Class I impact would occur including 1,300 acres of Mojavean creosote bush scrub and 10 acres of desert salt bush scrub, and 10 acres of Class II impact consisting of loss of wetland/riparian vegetation.

Plant Species of Special Concern. Five federal candidate species, including wild buckwheat, which is a State of Nevada designated endangered species, are known to occur in the vicinity of the pipeline route. Habitat (1,310 acres) required by these species would be traversed by the pipeline. Consequently, there is a potential for significant impact (Class II) occurring to these species as a result of pipeline construction along this route.

4.4.4.7.2 Wildlife

General Wildlife. No significant impacts would be expected to occur to general wildlife populations as a result of the North Las Vegas Variation.

Species of Special Concern. Thirty-five miles of crucial desert tortoise habitat would be crossed by the proposed variation. Construction activities during winter hibernation or daily summer aestivation could result in crushing of individuals or greater susceptibility to predation. Active tortoise could be lost to the operation of heavy equipment. Assuming 50 tortoise/sq mi, as many as 33 individuals could be lost due to pipeline construction. This loss would be considered significant.

4.4.4.7.3 Grazing

Criteria used to evaluate potential impacts to grazing along these proposed route variations are the same as those listed in Section 4.2.7.3.

The proposed route variation involves less than one percent of any allotment that would be traversed or traverse private lands (Appendix D); therefore, no significant impacts to grazing would occur.

Table 4.4-20
VEGETATION TYPES AND DENUDED ACREAGES, NORTH LAS VEGAS VARIATION

Geographic Region	Vegetation Type	Impact Class 2/	Denudation 1/ (acres) Short Term 3/	Long Term 4/	Permanent 5/	Total
Mojave Desert	Mojavean creosote bush scrub	I	0	0	1296.8	1296.8
	Wetland/riparian	II	6.1	6.0	0	12.1
	Desert saltbush scrub	I	0	0	12.1	12.1
		TOTAL	6.1	6.0	1308.9	1321.0
SUMMARY BY IMPACT CLASS 2/						
	Class	I	0	0	1308.9	1308.9
	Class	II	6.1	6.0	0	12.1
	Class	III	0	0	0	0
	Class	IV	0	0	0	0
		TOTAL	6.1	6.0	1308.9	1321.0

1/ vegetation loss assuming a 100-foot wide construction ROW and a 50-foot wide operational ROW.

2/ see section 4.2.7.1 for definitions of impact classes.

3/ short term loss = vegetation loss within community types with fair or better revegetation potential; vegetation loss within total 100-foot wide construction ROW if large woody shrubs or trees not present; vegetation loss short term within the 50-foot wide portion of the construction ROW not used for operation with large woody shrubs and trees present; vegetation loss would not be significant.

4/ long term loss = loss of vegetation within community types with fair or better revegetation potential containing large woody shrubs or trees present in operational ROW (50-foot wide) which would hamper operations and, therefore, would not be allowed to re-establish in the operational ROW during the life of the project; vegetation loss would not be significant.

5/ permanent loss = loss of vegetation within community types with poor or worse revegetation potential; vegetation loss would be significant.

4.4.4.8 Socioeconomics

4.4.4.8.1 Population, Housing, and Economic Impacts

The variation utilizing the Goodsprings Spur would require 110.6 miles of pipeline, compared to 96.20 miles for the corresponding section of the primary route. Compressor Station Number 5 would be relocated to the vicinity of Goodsprings, Clark County, Nevada. The expected socioeconomic impacts would be very similar to the proposed project. Impacts in the vicinity of Goodsprings would be higher, however, and the impacts in the vicinity of MP 518 or 20 miles south of Las Vegas would be correspondingly less due to the relocation of Compressor No. 5.

4.4.4.8.2 Traffic

Five paved roads will be crossed, but since they will be bored under, no impacts are expected to occur.

4.4.4.8.3 Noise

If the North Las Vegas Variation with the Goodsprings Spur were constructed, Compressor Station No. 5 would require relocation to the vicinity of Goodsprings, Nevada. No compression changes would be required. Since the exact location of the compressor station has not been determined, the noise impacts cannot be quantified.

4.4.4.8.4 Recreational Resources

Temporary disruption of activities and safety considerations could be the primary short- and long-term impacts on Off-Road Vehicle Recreation Area 13 near Goodsprings in Clark County, Nevada. ORV use of this area would be interrupted or impeded during the construction phase of the pipeline, especially if construction takes place during the winter months of peak use.

Long-term significant impacts would consist of potential accident hazards in the form of above-ground markers, signs, or valves.

4.4.4.9 Land Ownership/Use

There would be a significant impact on the proposed Husite project since the proposal alignment departs from the curvilinear placement of the major streets of their master plan. The three miles of Nellis Air Force Base requires consultation with and permission from Air Force officials but no impact has been identified. Refer to Table 4.4-21 for construction and operation impacts for this variation by land ownership. Table 4.4-22 shows the number of acres disturbed by land use category.

Table 4.4-21

CONSTRUCTION AND OPERATION DISTURBANCE BY LAND OWNERSHIP, NORTH LAS VEGAS VARIATION

Disturbance Area	Total Acres	Private Acres	BLM Acres	DOD Acres	Indian Acres
Clark County, Nevada					
100'Construction	1321.2	253.3	860.6	36.4	173.3
50' Operation	660.6	126.7	430.3	18.2	86.7

Table 4.4-22

CONSTRUCTION AND OPERATION DISTURBANCE BY LAND USE, NORTH LAS VEGAS VARIATION

Disturbance Area	Total Acres	Grazing/ Rangeland Acres	Irrigated Non-Irrigated Agriculture Acres	Residen-tial Acres	Other Acres 1/
Clark County, Nevada					
100'Const.	1321.2	1054.5	12.1	218.2	36.4
50' Oper.	660.6	527.3	6.1	209.1	18.2

1/ Nellis Air Force Base

4.4.4.10 Cultural Resources

4.4.4.10.1 Archaeology

Direct Impacts. Six known sites are located in the zone of direct impact. They include three lithic scatters, a quarry and associated lithics, a roomblock with associated lithic-ceramic scatter, and a historic telephone line. None of these sites is located along the Goodsprings Spur. Only 17.1 percent of the direct impact zone has been surveyed.

Indirect Impacts. A total of 21 known sites are located in the zone of indirect impact. They consist of two rockshelter sites (including one associated with a cave), a rock ring and associated lithics, a campsite, two roomblocks and associated artifact scatter, four lithic scatters, seven isolated finds, and a historic camp and associated dump. They also include a Spanish Trail marker that has been declared a Nevada State Monument. None of these sites is located along the Goodsprings Spur.

There is one high sensitivity pipeline segment along this route.

4.4.4.10.2 American Indian Concerns

The Moapa River Indians are particularly concerned about this proposed variation which would run through most of their recently acquired tribal lands to the south. Some expressed considerable concern about systems safety (gas explosions), harm to ancestral sites, sacred areas and traditional use areas, erosion of tribal lands due to the effects of pipeline construction and the cutting of access roads, and possible land use conflicts. The Moapa plan to lease their lands to ordnance manufacturers and they are concerned about a possibility of a gas pipeline crossing their reservation. The Moapa River Indians are also concerned about impacts to any ancestral (archaeological) sites situated in traditional ethnographic use areas, such as Dry Lake Valley and the Moapa Valley.

4.4.4.11 Paleontological Resources

The North Las Vegas Variation with the Goodsprings Spur would traverse 107.7 miles of formations which have been determined significant, and 1.3 miles of formations which have been determined not significant.

4.4.4.12 Visual Resources

No areas of visual impact were identified along this route.

4.4.4.13 System Safety and Reliability

The North Las Vegas Variation with the Goodsprings Spur would be approximately 14 miles longer than the primary route. This variation would pass through Husite, a planned development area which includes high- and low-density residential areas and a residential area north of Las Vegas. The route crosses the Las Vegas Shear Zone. No other unique geologic features were identified along this route.

4.4.5 Henderson Variation

4.4.5.1 Air Quality

Air quality emissions and impacts would be essentially the same as under the proposed primary route which was presented in Section 4.2.1. Total overall construction emissions would be slightly higher than those presented in Section 4.2.1 since this variation is approximately 1.4 miles longer. Operation phase emissions and impacts would be identical to those in Section 4.2.1.

4.4.5.2 Geology

Refer to Section 4.4.2.

4.4.5.2.1 Seismicity and Faulting

Potential impacts associated with fault crossings and soil liquefaction are similar to those discussed in Section 4.2.2.2. The proposed route would cross the Whitney Mesa Fault, which has evidence of Quaternary activity [Weide, 1982a, 1982b; Nakata et al., 1982].

4.4.5.2.2 Slope Stability

The potential effects of slope stability problems associated with pipeline construction and long-term stability are addressed in Section 4.2.2.3.

4.4.5.2.3 Subsidence

Comments with respect to the North Las Vegas Variation in Section 4.4.2.2.3 also apply to the Henderson Variation. Groundwater overdrafting has occurred in the Las Vegas Valley and has created subsidence in the past [Bell, 1981].

4.4.5.2.4 Flash Floods and Debris Flows

Comments made with respect to the proposed mainline through the Basin and Range region in Section 4.2.2.5 also apply to the Henderson Variation.

4.4.5.3 Soil

Refer to Section 4.2.3 for a general discussion on impacts that could occur to soils due to pipeline construction, criteria used to delineate significant impacts, as well as a general description of methodology used to assess impacts. The distribution of potential soils impacts is summarized in Table 4.4-23.

The probability for significant water and wind erosion along the route of this proposed variation is mostly low and moderate. The dominantly poor reclamation potential indicates significant revegetation problems.

Table 4.4-23

DISTRIBUTION OF POTENTIAL SOILS IMPACTS, HENDERSON VARIATION

		Erosion Potential 1/						Reclamation Potential 2/ (miles) 3/		
		Water (miles) 3/			Wind (miles) 3/					
Milepost	Geographic Area	L	M	H	L	M	H	G	F	P
0.0-15.3	Mojave Desert	13.2	2.1	0.0	7.7	7.6	0.0	0.0	1.0	14.3

1/Water Erosion Potential

L(low) = less than 5 tons/acre/year (low probability for significant erosion impacts).
M(moderate) = 5 to 20 tons/acre/year (near even probability for significant erosion impacts).
H(high) = greater than 20 tons/acre/year (high probability for significant erosion impacts).

Wind Erosion Potential

L(low) = low probability for significant erosion impact.
M(moderate) = near even probability for significant erosion impacts. Impact potential also dependent upon site specific exposure to prevailing winds.
H(high) = high probability for significant erosion impacts. Impact potential also dependent upon site specific exposure to prevailing winds.

2/Reclamation Potential

Ratings are based upon trenching with no selective soil handling or other mitigation.
G(good) = good probability for restoring vegetation which will support pre-existing land use. Productivity potential may be somewhat reduced.
F(fair) = near even probability for restoring vegetation which will support pre-existing land use within short periods of time. Time needed for re-establishment is likely to be longer than soils with good potential. Productivity potential may be reduced.
P(poor) = low probability for restoring vegetation which will support pre-existing land use within a short period of time. Time needed for re-establishment is likely to be long. Productivity potential may be reduced.

3/Cumulative miles for pipeline segment.

4.4.5.4 Surface Water

Approximately 15 intermittent streams would be crossed by the pipeline. Impacts that would occur as a result of pipeline construction, operation, and abandonment within the Mojave Desert were previously described in Section 4.2.4.1.4.

4.4.5.5 Groundwater

There is a high potential for impact along the entire route of this variation where the water table is shallow, of good quality, and use is high.

4.4.5.7 Terrestrial Biology

4.4.5.7.1 Vegetation

General Vegetation. Approximately 190 acres of Mojavean creosote bush scrub vegetation would be denuded due to the construction of the Henderson Variation which would be a Class I impact.

Plant Species of Special Concern. Five federal candidate species, including wild buckwheat, which is a State of Nevada designated endangered species, are known to occur in the vicinity of the pipeline route. Habitat (190 acres) required by these species would be traversed by the pipeline. Consequently, there is a potential for significant impact (Class II) occurring to these species as a result of pipeline construction along this route.

4.4.5.7.2 Wildlife

Criteria used to determine significance of impacts and general impacts associated with construction of the proposed Henderson Variation are the same as those described for the Kern River mainline (Section 4.2.7.2).

General Wildlife. No significant impacts would be expected to occur to general wildlife populations as a result of construction of the proposed Henderson Variation.

Wildlife Species of Special Concern. No significant impacts to species of special concern would be expected to occur as a result of construction of the proposed pipeline. Loss of potential habitat would be a Class III impact.

4.4.5.7.3 Grazing

Criteria used to evaluate potential impacts to grazing along these proposed route variations are the same as those listed in Section 4.2.7.3.

The proposed route variation involves less than one percent of any allotment that would be traversed or traverse private lands (Appendix C); therefore, no significant impacts to grazing would occur.

4.4.5.8 Socioeconomics

4.4.5.8.1 Population, Housing, and Economic Impacts

The total length of this variation is 16.8 miles, about 1.4 miles longer than the primary route in this area. The compressor requirements would be the same as would the socioeconomic impacts since the length of pipeline to be constructed and its location are virtually the same as the proposed project.

4.4.5.8.2 Traffic

Two paved roads would be crossed but since both will be bored under, no delays in traffic are expected to occur.

4.4.5.8.3 Noise

Pipeline construction along the proposed route variation would cause the same types of impacts as those discussed in Section 4.2.8.3. Due to the temporary nature of pipeline construction, noise will not be considered a significant impact along this variation.

4.4.5.8.4 Recreational Resources

Since no developed recreational areas occur, no impacts are expected.

4.4.5.9 Land Ownership/Use

There are no anticipated land use impacts with the Henderson Variation. Since this variation was suggested by the City of Henderson, it would be in compliance with their land use plans.

Table 4.4-24 shows the construction and operation impacts for this variation by land ownership. Table 4.4-25 shows the number of acres disturbed by land use category.

Table 4.4-24

CONSTRUCTION AND OPERATION DISTURBANCE BY LAND OWNERSHIP, HENDERSON VARIATION

County, State	Disturbance Area	Total Acres	Private Acres
Clark, NV	100' Construction	185.5	185.5
	50' Operation	93.7	92.7

Table 4.4-25

CONSTRUCTION AND OPERATION DISTURBANCE BY LAND USE, HENDERSON VARIATION

County, State	Disturbance Area	Total Acres	Residential Acres
Clark, NV	100' Construction	185.5	185.5
	50' Operation	92.7	92.7

4.4.5.10 Cultural Resources

4.4.5.10.1 Archaeology

No documented sites lie within the zone of direct or indirect impact. Only 9.8 percent of the direct impact zone has been surveyed.

4.4.5.10.2 American Indian Concerns

For general concerns about impacts along the Kern River pipeline, see Section 4.2.10.2. There are no additional concerns to relate for this variation.

4.4.5.11 Paleontological Resources

All of the paleontological resources encountered along the Henderson Variation (15.3 miles) have been determined to be significant.

4.4.5.12 Visual Resources

No areas of visual resources were identified along this route.

4.4.5.13 System Safety and Reliability

The Henderson Variation would be approximately 1.4 miles longer than the primary route. This variation bypasses some undeveloped, subdivided areas of Henderson. It still traverses approximately 7.5 miles of Henderson. Geologic conditions are approximately the same as for the primary route.

4.4.6 North Bakersfield Variation

4.4.6.1 Air Quality

Air quality emissions and impacts would be essentially the same as under the proposed primary route which was presented in Section 4.2.1. Total overall construction emissions would be slightly higher than those presented in Section 4.2.1 since this variation is approximately one mile longer. Operation phase emissions and impacts would be identical to those in Section 4.2.1.

4.4.6.2 Geology

Refer to Section 4.2.2.

4.4.6.2.1 Seismicity and Faulting

Potential impacts associated with fault crossings and soil liquefaction are similar to those discussed in Section 4.2.2.2.

The North Bakersfield Variation would cross the White Wolf, Edison, Kern Front, and a series of smaller faults. Local movement occurred on these faults during the 1952 Kern County earthquake [Buwalda and St. Amand, 1955].

4.4.6.2.2 Slope Stability

Slopes along the north side of Tehachapi Valley and Tertiary age sedimentary formations north and west of Caliente may be more prone to landsliding than areas crossed along the Tehachapi Mountains portion of the primary Kern River route.

4.4.6.2.3 Subsidence

Comments with respect to the proposed Kern River mainline in Section 4.2.2.4 apply to the North Bakersfield Variation.

4.4.6.2.4 Flash Floods and Debris Flows

Refer to Section 4.2.2.5.

4.4.6.3 Soil

Refer to Section 4.2.3 for a general discussion on impacts that could occur to soils due to pipeline construction, criteria used to delineate significant impacts, as well as a general description of methodology used to assess impacts. The distribution of potential soils impacts is summarized in Table 4.4-26.

4.4.6.3.1 Tehachapi Mountains (MP 0-33)

In the Tehachapi Mountains area the probability for significant water erosion is mostly moderate and high. The probability for significant wind erosion is mostly moderate. Reclamation potential is mostly fair and poor, indicating significant revegetation problems.

4.4.6.3.1 San Joaquin Valley (MP 33-111)

In the San Joaquin Valley area the probability for significant water erosion is mostly low and moderate, with high probability occurring on shorter segments of the route located on steep slopes. The potential for significant wind erosion is mostly low. Revegetation potential is mostly good and fair, indicating that significant revegetation problems would be confined to a few relatively short segments.

4.4.6.4 Surface Water

No significant impacts would be expected to the approximately 21 intermittent streams, numerous ephemeral streams, and one perennial stream, the Kern River, which would be crossed by the pipeline. In addition, 14 irrigation canals and drainage ditches would be crossed, many of which are large concrete structures which carry large amounts of flow. The Kern River crossing has a low sensitivity due to the relatively low channel and sideslope gradients. If flow was impaired or withheld due to construction, significant impact to water users could occur. Impacts that would occur to surface water resources as a result of pipeline construction, operation, and abandonment within these regions were previously described in Sections 4.2.4.1.5 and 4.2.4.1.6.

4.4.6.5 Groundwater

A low potential for significant impact occurs along this variation. Refer to Section 4.2.5.

Table 4.4-26

DISTRIBUTION OF POTENTIAL SOILS IMPACTS, NORTH BAKERSFIELD VARIATION

		Erosion Potential 1/						Reclamation Potential 2/ (miles) 3/		
		Water (miles) 3/			Wind (miles) 3/					
Milepost	Geographic Area	L	M	H	L	M	H	G	F	P
0.0-33.0	Tehachapi Mtns	4.0	13.0	16.0	2.0	31.0	0.0	4.0	14.0	15.0
33.0-111.0	San Joaquin Valley	58.0	12.0	8.0	66.0	5.5	6.5	58.0	12.0	8.0

1/Water Erosion Potential

L(low) = less than 5 tons/acre/year (low probability for significant erosion impacts).

M(moderate) = 5 to 20 tons/acre/year (near even probability for significant erosion impacts).

H(high) = greater than 20 tons/acre/year (high probability for significant erosion impacts).

Wind Erosion Potential

L(low) = low probability for significant erosion impact.

M(moderate) = near even probability for significant erosion impacts. Impact potential also dependent upon site specific exposure to prevailing winds.

H(high) = high probability for significant erosion impacts. Impact potential also dependent upon site specific exposure to prevailing winds.

2/Reclamation Potential

Ratings are based upon trenching with no selective soil handling or other mitigation.

G(good) = good probability for restoring vegetation which will support pre-existing land use. Productivity potential may be somewhat reduced.

F(fair) = near even probability for restoring vegetation which will support pre-existing land use within short periods of time. Time needed for re-establishment is likely to be longer than soils with good potential. Productivity potential may be reduced.

P(poor) = low probability for restoring vegetation which will support pre-existing land use within a short period of time. Time needed for re-establishment is likely to be long. Productivity potential may be reduced.

3/Cumulative miles for pipeline segment.

4.4.6.6 Freshwater Biology

The California Aqueduct would be the most important aquatic habitat crossed by the North Bakersfield Variation. Due to the nature of canal crossings, no significant impacts would be expected to result from this crossing or from the Kern River crossing.

4.4.6.7 Terrestrial Biology

4.4.6.7.1 Vegetation

General Vegetation. Approximately 1,350 acres of vegetation would be denuded during the construction of the proposed variation. Table 4.4-27 lists the vegetation types and acreages of each type that would be removed during construction. No Class I impact would occur as a result of construction. Approximately 570 acres of Class II impact would occur including 350 acres of agricultural land, 210 acres of digger pine-oak woodland, and 10 acres of wetland/riparian at the Kern River crossing.

Plant Species of Special Concern. Four federal candidate species, which are also of concern to the CNPS, are known to occur in the vicinity of the pipeline route within the Tehachapi Mountains region. A description of the species and their habitats are included in Appendix C. The pipeline would traverse habitat required by these species. Consequently, there is a high potential that these species would be significantly impacted by the construction of the pipeline within this region (Class II).

Field surveys conducted for the California jewel flower within the Tehachapi Mountains did not encounter any individuals of the species. The field survey was initiated well after the optimum time for locating the annual species; however, approximately 1.0 mile of suitable habitat was located. Seeds of this annual species could lay dormant in the soil for extended periods without their presence being known. Therefore, the loss of habitat (approximately 12 acres) could significantly impact the species (Class II).

Sixteen species of special concern to the CNPS, including fifteen federal candidate species, are known to occur in the vicinity of the pipeline route in the San Joaquin Valley including the California listed species California jewel flower, Tulare pseudobahia, and striped adobe lily. Of the sixteen species the Comanche Point layia and the Bakersfield beavertail cactus are known to occur along the pipeline route. These two species would be significantly impacted by pipeline construction (Class II). The pipeline would traverse habitat required by all sixteen species. Consequently, there is a high potential that significant impact would occur to these species as a result of pipeline construction (Class II).

Table 4.4-27

VEGETATION TYPES AND DENUDED ACREAGES, NORTH BAKERSFIELD VARIATION

Geographic Region	Vegetation Type	Impact Class 2/	Denudation 1/ (acres)			
			Short Term 3/	Long Term 4/	Permanent 5/	Total
Tehachapi Mtns.	Agricultural land	II	48.5	0	0	48.5
	Digger pine-oak woodland	II	0	0	205.7	205.7
	Wetland/riparian	II	0.2	0.1	0	0.3
		Subtotal	48.7	0.1	205.7	254.5
San Joaquin Valley	Valley and foothill grassland	III	775.7	0	0	775.7
	Wetland/riparian	II	6.1	6.0	0	12.1
	Agricultural land	II	303.0	0	0	303.0
		Subtotal	1084.8	6.0	0	1090.8
SUMMARY BY TYPE						
	Agricultural land	II	351.5	0	0	351.5
	Digger pine - oak woodland	II	0	0	205.7	205.7
	Wetland/riparian	II	6.3	6.1	0	12.4
	Valley and foothill grassland	III	775.7	0	0	775.7
		TOTAL	1133.5	6.1	205.7	1351.5

Table 4.4-27 (continued)

VEGETATION TYPES AND DENUDED ACREAGES, NORTH BAKERSFIELD VARIATION

Geographic Region	Vegetation Type	Impact Class 2/	Denudation 1/ (acres) Short Term3/	Long Term4/	Permanent5/	Total
SUMMARY BY IMPACT CLASS 2/						
	Class	I	0	0	0	0
	Class	II	357.8	6.1	205.7	569.6
	Class	III	775.7	0	0	775.7
	Class	IV	0	0	0	0
		TOTAL	1133.5	6.1	205.7	1345.3

1/ vegetation loss assuming a 100-foot wide construction ROW and a 50-foot wide operational ROW.

2/ see section 4.2.7.1 for definitions of impact class.

3/ short term loss = vegetation loss within community types with fair or better revegetation potential; vegetation loss within total 100-foot wide construction ROW if large woody shrubs or trees not present; vegetation loss short term within the 50-foot wide portion of the construction ROW not used for operation with large woody shrubs and trees present; vegetation loss would not be significant.

4/ long term loss = loss of vegetation within community types with fair or better revegetation potential containing large woody shrubs or trees present in operational ROW (50-foot wide) which would hamper operations and, therefore, would not be allowed to re-establish in the operational ROW during the life of the project; loss would not be significant.

5/ permanent loss = loss of vegetation within community types with poor or worse revegetation potential; vegetation loss would be significant.

Field surveys were conducted for California jewel flower and Bakersfield beavertail cactus. No individuals of these species were encountered. Suitable habitat for California jewel flower and Bakersfield beavertail cactus was identified along three segments of the route for a total of 43.6 miles. Since potential habitat could be exploited by the species, loss of habitat (530 acres) could significantly impact these species (Class II).

4.4.6.7.2 Wildlife

Criteria used to determine significance of impacts and general impacts associated with construction of the proposed North Bakersfield Variation are the same as those described for the Kern River mainline (Section 4.2.7.2). The presence of species of special interest along the proposed variation is presented in Table 3.2-5.

General Wildlife. No significant impacts would be expected to occur to general wildlife populations as a result of construction of the proposed North Bakersfield Variation.

Wildlife Species of Special Concern. This variation would traverse essential California condor habitat that is utilized for foraging. No nests or roosts have been identified within the vicinity of the proposed corridor. Impacts would be expected to be relegated to short-term disturbance with individual birds reoccupying the affected area immediately after construction is terminated. This would be a Class III impact. Routine aerial inspections of the completed pipeline pose the potential risk of aircraft/condor collisions. Loss of any individuals would be a Class I impact. These aerial inspections could also disturb any condor utilizing the immediate area (Class III impact). However, since the remaining three condors existing in the wild will likely be captured for the captive breeding program prior to proposed construction, no impact to the condor is anticipated [Blum, 1986].

Suitable San Joaquin kit fox habitat would be traversed by 12 miles of pipeline on the east side of the San Joaquin Valley, and 23 miles on the west side of the Valley. Ground surveys identified one active natal den along the prposed route on the west side of the Valley. Kit fox were observed nightly during spotlighting surveys, indicating a stable population. If kit fox are present and natal dens occur along the ROW, construction activities when pups are in the dens from February to late April would result in the loss of individuals due to crushing or suffocation in collapsed dens. This would be a Class II impact. Construction activities would also cause a temporary displacement of local individuals, although reoccupation of the affected area would be expected soon after construction is completed. This would be a Class III impact. Natal dens appear to be somewhat traditional, and may represent ancestral breeding sites important to the successful reproduction of the species [BLM, 1984b]. As such, loss of natal den sites would be a Class II impact. Loss of less than one percent of suitable habitat would be a Class III impact.

Approximately 35 miles of blunt-nosed leopard lizard suitable habitat would be traversed by the proposed variation: 12 miles on the east side of the San Joaquin Valley and 23 miles along the west side of the valley. Ground surveys identified one viable population along the route on the east side, and four separate populations on the west side. Construction would result in the loss of an unknown number of individuals through crushing by construction equipment on the surface and destruction within their burrows. Some individuals may also be lost by falling into open trenches. Loss of individuals could be minimized, but not negated and would be a Class I impact. Habitat loss would be significant if revegetation efforts were to fail and weedy species were introduced which favored other lizard species and thus increased competition [BLM, 1984a]. Loss of approximately 430 acres of habitat would be a Class II impact. Increased access along the completed ROW would result in long-term habitat degradation and the potential loss of individuals through crushing by vehicles. Maintanence operations along the pipeline may also result in crushing of individuals. These are Class II impacts.

Suitable habitat for the Tipton kangaroo rat is limited along the proposed alignment; only six miles of this alignment would cross known suitable habitat. Construction activities would result in the loss of individuals residing within the ROW. These animals dig shallow burrows in friable soils that are susceptible to collapse from the weight of heavy equipment. They are weak diggers and if trapped in a collapsed burrow would have little chance of escaping. Because they are strictly nocturnal, daytime construction activities would be certain to trap individuals within their burrows. Losses would be minimal because of the limited occurrence of this species along the proposed route; however, any loss would be a Class I impact. Clearing of vegetation along the ROW would be a Class IV impact by reducing shrub cover and providing more of the open habitat type preferred by this species.

The proposed variation would traverse approximately 23 miles of short-nosed kangaroo range (approximately 280 acres). Ground surveys did not locate any active burrow systems along this variation; however, the potential for occurrence does exist along the western side of the San Joaquin Valley. This kangaroo rat digs shallow burrows in friable soils that are susceptible to collapse from the weight of heavy equipment. They are weak diggers and if trapped in a collapsed burrow would have little chance of escaping. Because they are strictly nocturnal, daytime construction activities would be certain to trap individuals within their burrows. Losses would be minimal because of their limited and sparse distribution; however, any loss would be a Class I impact. Clearing of vegetation along the ROW would be a

Class IV impact by reducing shrub cover and providing more of the open habitat type preferred by this species.

The giant kangaroo rat occurs in grassland habitat of the valley floors along the west side of the San Joaquin Valley. Ground surveys identified 58 active colonies in the vicinity of the proposed pipeline between the California Aqueduct and McKittrick. The proposed alignment would cross approximately 19 miles of suitable giant kangaroo habitat (approximately 180 acres).

Because giant kangaroo rats are strictly nocturnal and spend the daytime in shallow burrows, they would be highly susceptible to construction activities that would collapse burrows resulting in the loss of individuals. This would be a Class II impact. Some colonies are concentrated in small areas of suitable habitat, and it is conceivable that local populations could be decimated. Habitat disturbance may have a beneficial impact (Class IV) by removing shrubs creating the open habitat preferred by this species. A permanent ROW would provide additional barren areas that would be used by kangaroo rats for dust baths and loafing.

The proposed route would traverse approximately 23 miles of Nelson's antelope squirrel range from the California Aqueduct north to its terminus near McKittrick. Ground surveys during June and July of 1986 recorded 20 squirrels along this segment of the proposed route. Construction activities would disturb this species and there would potentially be a few individuals that would be crushed in their burrows by heavy equipment operations. However, this species is diurnally active and highly mobile, and would, in most cases, be able to avoid construction hazards. Loss of individuals could be minimized, but probably not negated, and would be a Class I impact. Construction disturbance may cause a temporary displacement of individuals, although they are expected to return soon after the construction phase is completed. This would be a Class III impact. Reduction of shrub cover would result in the loss of natural habitat for this species, a Class II impact. However, observations during ground surveys of the proposed route and observations by Williams [1980] indicate that a moderate amount of soil disturbance may actually create improved habitat conditions by providing additional burrow sites. As such, this would be a Class IV impact.

The Tehachapi slender salamander may exist along north-facing slopes within moist canyons and ravines in oak-pine woodlands, and are frequently found under rotting logs and accumulated leaf litter [SCRA et al., 1980]. The proposed pipeline traverses less than one mile of suitable habitat for this species. Construction activities within a viable population would result in the crushing of individuals. Loss of any individuals would be a Class II impact. Because of the limited amount of available suitable habitat, any loss would be a Class II impact.

The Tehachapi pocket mouse may be found on the lower western foothills of the Tehachapi Mountains; the four species of blister beetles also occur in these western foothills. At present it is unknown whether the proposed line would traverse any viable populations, and it must be assumed that an indeterminate number of individuals of each species would be lost due to short-term construction activities. Loss of individuals would be considered a Class II impact.

4.4.6.7.3 Grazing

Criteria used to evaluate potential impacts to grazing along these proposed route variations are the same as those listed in Section 4.2.7.3.

The proposed route variation involves less than one percent of any allotment that would be traversed or traverse private lands (Appendix D); therefore, no significant impacts to grazing would occur.

4.4.6.8 Socioeconomics

4.4.6.8.1 Population, Housing, and Economic Impacts

This variation would total 20.3 miles in a stretch of the proposed route that is 22.0 miles. Therefore, this variation is 1.7 miles shorter than the corresponding portion of the primary route. The socioeconomic impacts will be virtually identical to the proposed project.

4.4.6.8.2 Traffic

Nine paved roads, two with relatively high traffic volumes, would be crossed. Since all will be bored under, no delays are anticipated.

4.4.6.8.3 Noise

Pipeline construction along the proposed route variation would cause the same types of impacts as those discussed in Section 4.2.8.3. Due to the temporary nature of pipeline construction, increased noise would not represent a significant impact.

4.4.6.8.4 Recreational Resources

The Kern River County Park has a number of developed group activity facilities (golf course, soccer field, etc.), but since the pipeline corridor is located at the westernmost portion of the park, the potential for disruption of recreational activities is limited to possible delays in traffic near the park. These would constitute a short-term impact.

4.4.6.9 Land Ownership/Use

Other than the agricultural land traversed, there are no anticipated impacts. Refer to Table 4.4-28 for construction and operation impacts for this variation by land ownership. Table 4.4-29 shows the number of acres disturbed by land use category.

Table 4.4-28

CONSTRUCTION AND OPERATION DISTURBANCE BY LAND OWNERSHIP, NORTH BAKERSFIELD VARIATION

Disturbance Area	Total Acres	Private Acres	BLM Acres	DOD Acres
Kern County, California				
100' Construction	1345.5	1260.6	48.5	36.4
50' Operation	672.7	630.3	24.2	18.2

Table 4.4-29

CONSTRUCTION AND OPERATION DISTURBANCE BY LAND USE, NORTH BAKERSFIELD VARIATION

Disturbance Area	Total Acres	Grazing/ Rangeland Acres	Irrigated/ Non-Irrigated Agriculture Acres	Residential Acres	1/ Other Acres
Kern County, California					
100' Constr.	1087.2	1030.3	206.1	72.7	36.4
50' Opera.	672.7	515.2	103.0	36.4	18.2

1/ Elk Hills NPR

4.4.6.10 Cultural Resources

4.4.6.10.1 Archaeology

Direct Impacts. There are four known sites that fall within the zone of direct impact: a prehistoric or protohistoric mound site, a habitation site with lithics, a hearth site with lithics, and a bedrock mortar site. Only 8.1 percent of the direct impact zone has been surveyed.

Indirect Impacts. A lithic scatter falls within the zone of indirect impact.

4.4.6.10.2 American Indian Concerns

For general concerns about impacts along the Kern River pipeline, see Section 4.2.10.2. There are no additional concerns to relate for this variation.

4.4.6.11 Paleontological Resources

The North Bakersfield variation would traverse 45.9 miles of formations determined to be significant and 65.1 miles of formations which have been determined not significant.

4.4.6.12 Visual Resources

No areas of visual impact were identified along this route.

4.4.6.13 System Safety and Reliability

The North Bakersfield Variation would be approximately 1.1 miles longer than the primary route. The mainline would be approximately 16 miles shorter; however, the Taft Lateral would be approximately 17 miles longer.

This variation would pass near the town of Caliente. It would then pass through Kern Bluff Oil Field portion of Bakersfield bypassing the residential area crossed by the Kern River Lateral portion of the primary route. The Taft Lateral would then pass scattered residences as it passes around Bakersfield to its end point.

This variation would cross active faults at MP 18 and MP 19 in remote areas. A series of faults are crossed between MP 30 and MP 40, east of Bakersfield. Another fault is crossed near MP 50 north of Bakersfield. This variation does not pass through any areas of known slope instability or other unique geologic features which could impact the pipeline.

4.5.1 East Las Vegas System Alternative

The East Las Vegas System Alternative would incorporate the impacts from the proposed Kern River Mainline between MP 0 and 491 and the Kern River and Taft Laterals (see Section 4.2). The discussion below describes the impacts of a pipeline between MP 491 of the Kern River route and the interconnection with the existing SoCal and PG&E intrastate transmission facilities located south of Needles, California. At this point, westward to the appropriate location of the proposed Kern River lateral bifurcation point, no facilities would be needed since existing gas transmission lines would carry the gas to the Bakersfield area. The reader is referred to Section 4.4.1 of Volume I for environmental consequences data on the proposed compressor station at Danby, California.

4.5.1.1 Air Quality

See Section 4.2.1 for a discussion of air quality impacts in Nevada.

4.5.1.2 Geology

Refer to Section 4.2.2. The potential geologic hazards identified for the East Las Vegas Variation are discussed below by category.

4.5.1.2.1 Seismicity and Faulting

Potential impacts associated with seismic hazards are addressed in Section 4.2.2.2. The proposed alternative would not cross any faults with evidence of Quaternary movement.

4.5.1.2.2 Slope Stability

No slope instability would be expected along this proposed alternative.

4.5.1.2.3 Subsidence

Comments with respect to the proposed Kern River mainline in Section 4.2.2.4 also apply to the East Las Vegas Variation. Groundwater overdrafting in the Las Vegas Valley has created subsidence in the past [Bell, 1981]. Also refer to Section 4.4.4.2.3.

4.5.1.2.4 Flash Floods and Debris Flows

Comments made with respect to the proposed mainline through the Basin and Range and Mojave Desert regions in Section 4.2.2.5 also apply to the East Las Vegas Variation.

4.5.1.2.5 Mineral/Petroleum Resources

Mineral deposits, including gold, silver, lead, and zinc are known to occur in the area of the proposed route. Numerous abandoned mine sites are found along the mountains bordering the El Dorado and Piute Valleys [Nevada Bureau of Mines, 1964] near Searchlight, Nevada. Therefore, an unquantified number of mine claims could be affected by construction of this variation.

4.5.1.3 Soil

Refer to Section 4.2.3 for a general discussion on impacts that could occur to soils due to pipeline construction, criteria used to delineate significant impacts, as well as a general description of methodology used to assess impacts. The distribution of potential soils impacts is summarized in Table 4.5-1.

The probability for significant water and wind erosion along the route of this proposed variation within the Mojave Desert (MP 0-105) is mostly low to moderate. The dominantly fair and poor reclamation potential indicates significant revegetation problems.

4.5.1.4 Surface Water

Only one significant intermittent to perennial stream, Las Vegas Wash, in addition to numerous ephemeral to intermittent streams, would be crossed by the pipeline. Impacts specific to the crossing of Las Vegas Wash, and to the surface water within the Mojave Desert in general were previously discussed in Section 4.2.4.1.4.

4.5.1.5 Groundwater

A low potential for impact occurs along the northern portion of this alternative where the water table is at great depth and use is high.

4.5.1.6 Freshwater Biology

No significant aquatic resources that would be directly impacted by pipeline construction exist along the route of the proposed East Las Vegas Variation; however, a number of intermittent and ephemeral washes that are tributary to the Colorado River and Lake Mohave would be crossed. Indirect impacts to these bodies of water resulting from pipeline construction at the crossings of the washes and intermittent streams would not be significant.

Table 4.5-1

DISTRIBUTION OF POTENTIAL SOILS IMPACTS, EAST LAS VEGAS SYSTEM ALTERNATIVE

		Erosion Potential 1/						Reclamation Potential 2/ (miles) 3/		
		Water (miles) 3/			Wind (miles) 3/					
Milepost	Geographic Area	L	M	H	L	M	H	G	F	P
0.0-93	Mojave Desert	65.0	26.0	13.5	53.3	38.7	12.5	14.1	26.8	63.6

1/Water Erosion Potential
L(low) = less than 5 tons/acre/year (low probability for significant erosion impacts).
M(moderate) = 5 to 20 tons/acre/year (near even probability for significant erosion impacts).
H(high) = greater than 20 tons/acre/year (high probability for significant erosion impacts).

Wind Erosion Potential
L(low) = low probability for significant erosion impact.
M(moderate) = near even probability for significant erosion impacts. Impact potential also dependent upon site specific exposure to prevailing winds.
H(high) = high probability for significant erosion impacts. Impact potential also dependent upon site specific exposure to prevailing winds.

2/Reclamation Potential
Ratings are based upon trenching with no selective soil handling or other mitigation.
G(good) = good probability for restoring vegetation which will support pre-existing land use. Productivity potential may be somewhat reduced.
F(fair) = near even probability for restoring vegetation which will support pre-existing land use within short periods of time. Time needed for re-establishment is likely to be longer than soils with good potential. Productivity potential may be reduced.
P(poor) = low probability for restoring vegetation which will support pre-existing land use within a short period of time. Time needed for re-establishment is likely to be long. Productivity potential may be reduced.

3/Cumulative miles for pipeline segment.

4.5.1.7 Terrestrial Biology

4.5.1.7.1 Vegetation

General Vegetation. Approximately 1,270 acres of vegetation would be denuded by construction of the proposed East Las Vegas Variation as indicated in Table 4.5-2. Approximately 1,260 acres of Class I impact would occur including 1,020 acres of Mojavean creosote bush scrub, 180 acres of desert saltbush scrub, and 60 acres of Joshua tree woodland. Approximately 10 acres of wetland/riparian vegetation would be lost which would be a Class II impact.

Species of Special Concern. Two federal candidate plant species are known to occur in the vicinity of the pipeline route. The pipeline would traverse 1,260 acres of habitat required by these species. Consequently, there is a high potential that these species would be significantly impacted by pipeline construction (Class II).

4.5.1.7.2 Wildlife

Criteria used to determine significance of impacts and general impacts associated with construction of the proposed East Las Vegas Variation are the same as those described for the Kern River mainline (Section 4.2.7.2). The presence of species of special interest along the proposed variation is presented in Table 3.2-5.

General Wildlife. Raptors could potentially nest within 0.5 mile of the proposed route. At present no nests are known to occur within the area of concern. If active raptor nests were present, construction activities during nesting would be a Class II impact. Gambel's quail occur within the area of concern. No crucial habitat would be disturbed by construction activities. Loss of vegetative cover would be a Class III impact.

Wildlife Species of Special Concern. In Nevada, the route would traverse one crucial tortoise habitat for a total of 16 miles. Nevada crucial desert tortoise habitat is designated by having tortoise densities greater than 40/sq mi. In California, the proposed ROW would cross 4.8 miles of high density habitat (100-250 animals per square mile), 14.4 miles of moderate density habitat (50-100 per square mile) and 12 miles of low density habitat (20-50 per square mile). Construction and revegetation activities at any time of year would result in loss of individuals from crushing on the surface or inside burrows; loss of cover and increased human activity would increase tortoise susceptibility to predators. Tortoises could also be lost by falling into the open pipeline trench. Assuming an average density of 40 tortoise/sq mi within the Nevada crucial habitat, and the midpoint density figures for the three habitat described densities in California (i.e. 175/mi^2, 75/mi^2, 35/mi^2), and a 100

Table 4.5-2

VEGETATION TYPES AND DENUDED ACREAGES, EAST LAS VEGAS SYSTEM ALTERNATIVE

			Denudation 1/ (acres)			
Geographic Region	Vegetation Type	Impact Class 2/	Short Term 3/	Long Term 4/	Permanent 5/	Total
Mojave Desert	Mojavean creosote bush scrub	I	0	0	1024.1	1024.1
	Wetland/riparian	II	6.1	0	0	6.1
	Desert saltbush scrub	I	0	0	175.7	175.7
	Joshua tree woodland	I	0	0	60.6	60.6
		TOTAL	6.1	0	1260.4	1266.5
SUMMARY BY IMPACT CLASS 2/						
	Class	I	0	0	1260.4	1260.4
	Class	II	6.1	0	0	6.1
	Class	III	0	0	0	0
	Class	IV	0	0	0	0
		TOTAL	6.1	0	1260.4	1266.5

1/ vegetation loss assuming a 100-foot wide construction ROW and a 50-foot wide operational ROW.

2/ see section 4.2.7.1 for definitions of impact classes.

3/ short term loss = vegetation loss within community types with fair or better revegetation potential; vegetation loss within total 100-foot wide construction ROW if large woody shrubs or trees not present; vegetation loss short term within the 50-foot wide portion of the construction ROW not used for operation with large woody shrubs and trees present; vegetation loss would not be significant.

4/ long term loss = loss of vegetation within community types with fair or better revegetation potential containing large woody shrubs or trees present in operational ROW (50-foot wide) which would hamper operations and, therefore, would not be allowed to re-establish in the operational ROW during the life of the project; vegetation loss would not be significant.

5/ permanent loss = loss of vegetation within community types with poor or worse revegetation potential; vegetation loss would be significant.

ft ROW, 56 tortoise would potentially be lost due to construction activities. Although detailed mitigation measures are available to minimize loss of individuals, it is assumed that they would not completely negate all losses. Therefore, loss of individuals would be a Class I impact. Because of the poor revegetation potential of the vegetation communities associated with the desert tortoise, loss of approximately 570 acres of suitable habitat would be a Class I impact. In addition, increased off-road vehicle access to these high density tortoise habitats along the completed ROW would increase vandalism to tortoises and long-term habitat deterioration. These are Class II impacts.

4.5.1.7.3 Grazing

Criteria used to evaluate potential impacts to grazing along these proposed route variations are the same as those listed in Section 4.2.7.3.

The proposed route variation involves less than one percent of any allotment that would be traversed or traverse private lands (Appendix D); therefore, no significant impacts to grazing would occur.

4.5.1.8 Socioeconomics

4.5.1.8.1 Population, Housing, and Economic Characteristics

This alternative would be very similar to the proposed project since the length of pipeline and associated other facilities would be very similar. Therefore, the estimated socioeconomic impacts would be very similar to the proposed project.

4.5.1.8.2 Traffic

Seven paved roads, one with high traffic volumes, would be crossed, but since all would be bored under, delays and/or detours are not anticipated.

4.5.1.8.3 Noise

Pipeline construction along this system alternative would cause the same types of impacts as those discussed in Section 4.2.8.3. Increased noise levels would be short-term and the temporary noise increases would be of greater impact where construction occurs in or adjacent to residential areas or schools. Due to the temporary nature of pipeline construction, increased noise would not represent a significant impact.

Noise impacts associated with the Kern River Compressor Stations 1 and 3 would remain unchanged. Noise impacts associated with the new compressor station at Danby were discussed in Section 4.5.8.4 of Volume I.

4.5.1.8.4 Recreational Resources

Short-term impacts would be experienced at both Rainbow Gardens and the proposed Clark County Wetlands Park in Clark County, Nevada. While construction is in progress the natural scenic beauty of both areas would be disturbed by construction workers, equipment, and noise. Some reduction in visual values may be experienced by recreational users.

4.5.1.9 Land Ownership/Use

There is one potential significant impact with the East Las Vegas portion of this alternative. It is proposed to pass through residential areas within the city limits of Henderson. Refer to Section 4.2.9.1 for mainline impacts.

Refer to Table 4.5-3 for construction and operation disturbance for this alternative by land ownership. Table 4.5-4 shows the number of disturbed acres by land use category.

Table 4.5-3

CONSTRUCTION AND OPERATION DISTURBANCE BY LAND OWNERSHIP, EAST LAS VEGAS SYSTEM ALTERNATIVE

County, State	Disturance Area	Total Acres	Private Acres	BLM Acres
Clark,	100' Construction	964.8	53.3	911.5
NV	50' Operation	482.4	26.7	455.8
San Bern.	100' Construction	304.2	53.3	250.9
CA	50' Operation	152.1	26.7	125.5
TOTAL	100' Construction	1266.7	106.7	1160.0
	50' Operation	633.3	53.3	580.0

Table 4.5-4

CONSTRUCTION AND OPERATION DISTURBANCE BY LAND USE, EAST LAS VEGAS SYSTEM ALTERNATIVE

County, State	Disturbance Area	Total Acres	Grazing/ Rangeland Acres	Residential Acres
Clark, NV	100'Constr.	934.5	813.3	121.2
	50' Opera.	467.3	406.7	60.6
San Bern. CA	100'Constr.	332.1	332.1	-
	50' Opera.	116.1	116.1	-
TOTAL	100'Constr.	1266.7	1145.5	121.2
	50' Opera.	633.3	572.7	60.6

4.5.1.10 Cultural Resources

4.5.1.10.1 Archaeology

Infofar as the precise routing of the East Las Vegas Variation was not known (Section 3.3.1.10), the numbers of direct and indirect impacts given below must be viewed as approximate figures.

Nevada. Four known sites fall within the zone of direct impact: a rockshelter and three lithic scatters.

Three known sites fall within the zone of indirect impact: a lithic scatter, a historic cemetery, and the historic mining settlement of Alunite.

California. Five known sites fall within the zone of direct impact: two lithic scatters, a camp site with lithics, portions of the Old Mojave Road, and portions of the National Old Trails Highway which is a California Historical Landmark (#781).

Six known sites fall within the zone of indirect impact: four lithic scatters, a rock cairn site, and a possible stone circle.

Summary. A total of nine known sites fall within the zone of direct impact, and nine known sites fall within the zone of indirect impact. One of the latter is a California Historical Landmark (#781). Note, however, that only 3.3 percent of the direct impact zone has been surveyed.

4.5.1.10.2 American Indian Concerns

Several American Indian groups are concerned about impacts to traditional ethnographic use areas as outlined in Section

3.3.1.10.2. Concerns about site specific impacts are limited to known ancestral (archaeological) sites listed in the previous section and to a possible direct impact to the Chemehuevi trade trail running from north of Needles to the Providence Mountains.

4.5.1.11 Paleontological Resources

The East Las Vegas Alternative portion of the route would transverse 80.2 miles of formations determined significant and 24.3 miles of formations determined not significant.

4.5.1.12 Visual Resources

MP 0-4, VRM/VQO: BLM Class II
This segment of the proposed route through Rainbow Gardens Wetlands (Las Vegas Wash) would create a high visual impact. The pipeline would pass through the wash area and be visible to park visitors. Seasonal fluctuation in water level and fast growieng riparian plant communities would create a short-term recovery rate. These impacts are significant.

4.5.1.13 Systems Safety and Reliability

The East Las Vegas/Integrated Intrastate System Alternative would replace 271 miles of pipeline in the Kern River proposal with 105 miles of new pipeline plus the use on existing SoCal Gas and PG&G pipelines. This would reduce the probability of a pipeline incident. This variation may also require approximately 75 miles of laterals similar to that proposed by Kern River. This route would pass through a residentially zoned area of Henderson, Nevada. It will also pass through a proposed resort community west of Boulder City adjacent to Lake Mead. The delivery laterals may pass through residential areas in the Bakersfield area. There are also some faults that may be crossed.

4.5.2 East Las Vegas Alternative with the Wasatch Variation

In this scenario the impacts from the proposed Kern River mainline between MP 0-74 and MP 204-491 and the Kern River and Taft Laterals would be examined (see Section 4.2). In addition the Wasatch Variation of the proposed Kern River mainline which replaces sections of the mainline between MP 74 and 204 would be examined (see Section 4.4.1). Finally the discussion on the East Las Vegas portion of the route (see Section 4.5.1) would be included.

4.5.3 Northwest/PGT/Integrated Intrastate System Alternative

Impacts for this scenario would be similar to those discussed for the El Paso Base Case (see Section 4.6.1, Volume I) and Transwestern (see Section 4.7, Volume I). Existing facilities would be employed for the remainder of the route across both southern California and Washington, Idaho, Oregon, and California.

4.6 CUMULATIVE IMPACTS

Cumulative impacts result when a project is added to an area in which other developments exist, are under construction, or are proposed. Although the impacts from the separate projects might be minor, the impacts from all the projects in an area could be significant. The interrelated projects presented in Chapter 2 along with the Kern River project were analyzed for cumulative impacts.

The resources which could sustain measurable cumulative impacts from the addition of the Kern River project would include land stability, vegetation, wildlife, socioeconomics, cultural resources, and visual resources. Table 4.6-1 lists the major overlapping scheduled projects and the cumulative affects the Kern River project would produce.

Vegetation resources could be affected in various ways by an accumulation of habitat loss in the vicinity of all of the projects listed. The cumulative affects on vegetation loss in these areas would be significant to the timber and Mojavean creosote bush scrub communities since revegetation of these community types would be a slow process.

These same portions of the route would also have a cumulative effect on wildlife species particularly the desert tortoise. The effects on desert tortoise habitat reduction as well as a habitat loss to general wildlife species would be significant.

Cumulative impacts would also occur to soils and land stability along those portions of the Kern River Proposal that are adjacent to or overlap the Central Utah Project facilities (mainline and West Strawberry Variation) or Mountain Fuel natural gas pipeline and Bountiful City electrical transmission line (Wasatch Variation). These interrelated projects cross steep rugged terrain with soil and land stability problems. Cumulative impacts would occur to these resources with each new use. The watershed values of the west slopes of the Wasatch range could be damaged, with resulting floods and debris flows into portions of residential areas of South Davis County.

A more restricted cumulative impact would involve water development and water quality conflicts particularly associated with the municipal watershed developments on the Wasatch Variation.

Table 4.6-1

KERN RIVER CUMULATIVE IMPACTS

Route	Project	Project Description	Location	Target Construction Period	Employment	Potential Conflicts With Required Coordination With Proposed Action
Kern River Mainline	Central Utah Project (CUP)	Six foot diameter pipeline to transport Uinta basin water to the Wasatch Front: reservoir portals, aqueducts, tunnels, access roads, and operation and maintenance buildings	MP 146-149	Unknown	20-40	Overlapping construction schedule requiring coordination of facility locations and rehabilitation
Kern River Mainline	Utah Power & Light Company (UP&L)	A 345 Kv transmission line, and proposed substation near MP 371	MP 341-406	Mid 1987-1990	20-40	Corridor sharing coordination for 65 miles involving vegetation clearing, access roads, rehabilitation, and construction scheduling. Coordination of facility locations.
Kern River Mainline	InterMountain Power Project (IPP)	500 Kv transmission line	MP 327-439 MP 475-484 MP 535-650	Completed	N/A	Corridor sharing coordination for 236 miles involving vegetation clearing, access roads, and rehabilitation.
Kern River Mainline	Mead/McCullough-Victorville/Adelanto Transmission Project	500 Kv transmission line	MP 535-676	Under construction		Corridor sharing coordination for 141 miles involving vegetation clearing, access roads, and rehabilitation.
Kern River Mainline and Taft Lateral	Celeron/All American and Getty Pipeline Projects	30 inch oil pipeline	MP 670-722 MP 725-762 MP 0-24T	Under construction	N/A	Corridor sharing coordination for 113 miles involving vegetation clearing, access roads, and rehabilitation.

Table 4.6-1 (continued)

KERN RIVER CUMULATIVE IMPACTS

Route	Project	Project Description	Location	Target Construction Period	Employment	Potential Conflicts With Required Coordination With Proposed Action
Wasatch Variation	Bountiful City Transmission Line	46 Kv transmission line	MP 27-40W	Mid 1987-Mid 1989	20	Corridor sharing coordination for 13 miles involving vegetation clearing, access roads, and rehabilitation.
Wasatch Variation	Mountain Fuels Natural Gas Pipeline	14 inch pipeline	MP 0-40W	Completed	N/A	Corridor sharing coordination for 40 miles involving vegetation clearing, access roads, and rehabilitation. Disturbance to areas that have or are being rehabilitated.
Wasatch Variation	Municipal Watershed Developments	Pipelines, spring boxes, treatment facilities, building, etc.	MPW 43-44W	Present to 1990	10	Pipeline corridor would cross through the water development area with potential conflicts to springs, water pipelines, water quality, and water distribution. Cumulative impacts to soil and slope stability.
West Strawberry Variation	CUP	Reconstruction, transporting to Six Water Drainage, portals, pipelines, and road systems	From East Portal to Six Water Drainage (on Strawberry N.W. 7.5' quad)	Unknown	20-45	Overlapping construction schedule requiring coordination of facilities locations and rehabilitation.
West Strawberry Variation	Mountain Fuel	10 inch natural gas pipeline from Indianola to St. George	1 mile on either side of Thistle Cr. (on Indianola 7.5' quad)	Late 1987-1989	20	Corridor sharing coordination for 2 miles involving vegetation clearing, access roads, and rehabilitation.

Cumulative effects of pipeline construction could occur to streams and springs regarding quantity and quality of water.

The major cumulative impact that would result from all of these projects would be in the area of socioeconomics. The employment requirements, housing and transportation needs, and increased tax benefits would be interrelated. Employment requirements for all of the projects could put a strain on the available employment market particularly in the isolated portions of central and southern Utah and the Mojave Desert. These employment impacts would be short term (usually less than one year). The longer term impacts involved with operation and maintenance should not cause problems.

Housing needs on a temporary basis could result in a short-term shortfall. If all of the projects were in construction simultaneously, the effects on the temporary housing market in most towns along the route would be stressed. Variations in construction scheduling to avoid overlaps should alleviate many of these problems. Transportation needs would be similar; appropriate scheduling should also resolve these problems.

Impacts to visual resources would increase with each new project. The cumulative impacts would change the visual quality objectives established by the Forest Service for several areas crossed by the mainline and West Strawberry Variation on the Uinta National Forest and the Wasatch Variation on the Wasatch-Cache National Forest. These visual objectives were established to protect scenic views from critical viewpoints, i.e., major highways, recreation trails and sites, and residential areas. The Kern River line would parallel portions of the Intermountain Power Project 500 kV and Utah Power and Light Company 345 kV transmission lines from north and central Utah to points south. The line would also parallel portions of the All-American Pipeline in the Mojave Desert. All of these lines would result in the need for additional ROW width, which in turn would affect visual quality objectives for the areas being crossed. However, the presence of transmission towers would present more of a visual intrusion than a buried pipeline.

4.7 PLANNED AND RECOMMENDED MITIGATION MEASURES

The following section presents mitigation measures proposed by the applicant and recommended by staff. In order to prevent repetition of mitigation measures, certain disciplines will not have all measures discussed since the measures would be appropriate for more than one discipline. Federal land management agency-recommended measures are presented in Section 4.10.6 of Volume I. Site-specific measures and stipulations for actual pipeline construction and operation activities on federal lands would be developed by federal land management agencies after certification by the FERC. For species of special concern, the certificated applicant(s) shall implement all mitigation measures formulated during formal consultation between the FERC staff and the Fish and Wildlife Service pursuant to the Endangered Species Act.

4.7.1 Kern River Mitigation Measures

4.7.1.1 Air Quality

Applicant Proposed Measures

General Impact: High dust levels would be present during construction.

1. Mitigation: The applicant plans to water the ROW to keep dust down to a manageable level.

   Effectiveness: This would reduce some of the impacts of inert pollutants; however, additional mitigation measures presented below could further reduce impacts to acceptable levels.

General Impact: Construction vehicle emissions would exceed stationary source levels.

2. Mitigation: Construction emissions would be mitigated through proper maintenance of construction equipment, and by maintaining manufacturer-installed exhaust systems for construction emissions.

   Effectiveness: Maintenance of emissions equipment would reduce construction vehicle exceedances.

Staff Recommended Measures

General Impact: High vehicle emissions would be present during construction.

3a. Additional Mitigation: The predicted exceedances could be mitigated if public access is restricted to outside a few hundred foot wide buffer zone. This would only be necessary in populated areas in California. This type of measure could be imposed by the State of California during the final permitting process.

3b. Additional Mitigation: Impacts shall be reduced by optimizing air-to-fuel ratios and retarded ignition timing. This could reduce NO_x emissions by up to 30 percent.

Effectiveness: These recommended measures would further reduce vehicle emissions and/or impacts during the construction phase.

4.7.1.2 Geology

Applicant Proposed Measures

General Impacts: Geologic and seismologic hazards may result in erosion and/or landslides and subsequent damage to the pipeline and related facilities.

4. Mitigation: Detailed geologic, seismological, and geotechnical studies would be conducted by the applicant to identify and characterize geologic hazards as appropriate along the Kern River Mainline, Taft Lateral and Kern River Lateral. In areas where hazards have been or are identified, information would be collected to aid in the design and construction of the pipeline and ancillary facilities. Emphasis would be placed on arroyo crossings to protect the pipeline from flash floods and debris flows. In general, care would be taken during construction to minimize surface disturbance and related soil erosion and to avoid altering drainages.

   Effectiveness: These studies would identify potentially hazardous areas and would allow for development of specific pipeline design criteria.

5. Mitigation: Additional studies would be conducted by the applicant to evaluate potential seismological hazards along the proposed route. The potential for surface offset along the Quaternary faults would be evaluated in detail so that appropriate pipeline crossings can be designed. Field studies would be completed to delineate the areas where movements may occur. An emphasis would be placed on studies of the Wasatch fault, the Garlock and the White Wolf faults, and in the southwest portion of the San Joaquin Valley where the Taft Lateral is near the San Andreas fault. Design features to compensate for ground motion would be developed for use in the seismic design of the pipeline and ancillary structures.

   Effectiveness: Identification of active faults would permit development of specific design criteria which would minimize the hazard of fault rupture.

6. Mitigation: It is not anticipated that construction of the proposed mainline would introduce water into the soil which could cause hydrocompaction. However, due care would be exercised during construction not to disturb the drainage of the affected area and to avoid producing any depressions in which water could pond.

   Effectiveness: These measures would adequately mitigate the potential for hydrocompaction and subsidence.

General Impact: Unstable slopes may result in landslides which could result in a pipeline rupture.

7. Mitigation: Detailed field studies would be undertaken to physically locate and characterize potentially unstable slopes and other surficial features of significance. Monitoring and surveillance programs would be implemented where deemed necessary. If an area is found to be totally unsuitable and appropriate stabilization measures cannot be implemented during construction to ensure the safety of the line, then the pipeline route would be moved laterally a sufficient distance to avoid the problem area.

   Effectiveness: These measures should result in reduction in the potential of pipeline rupture and damage to the environment if specific design criteria are implemented.

General Impact: Volcanic activity may cause damage to the pipeline.

8. Mitigation: The volcanic cinder cones would be investigated to determine the potential for an event which could disturb the Kern River Mainline.

   Effectiveness: Identification of areas with a significant likelihood of volcanic activity would allow consideration of a rerouting the pipeline.

Summary of Effectiveness of Planned Mitigation Measures: The applicants mitigation measures would in most instances resolve potential conflicts to hydrocompaction and avalanche hazard. In many instances the mitigation measure could resolve slope stability problems. However the degree of slope instability problems along portions of the route could not be mitigated by the measures discussed above.

Staff Recommended Measures

General Impact: Geologic and seismologic hazards may result in erosion and/or landslides and subsequent damage to the pipeline and related facilities.

9. Additional Mitigation: The FERC staff recommends submittal of results of the applicant's geotechnical studies indicated above, and submittal for review and approval of the following geotechnical studies and mitigating design measures prior to implementation of these measures. Such studies should include identification of: (a) all Holocene faults crossed by the proposed facilities; (b) all areas where potentially liquefiable deposits are crossed and likely effects on the facilities; and (c) all landslides or

areas of significant slope instability crossed by, or possibly affecting, the proposed facilities.

Specific mitigating measures should be developed to minimize the potential for slope failures, ruptures or failure of pipeline facilities wherever such failure could result in direct or indirect hazards to public safety and environmental resources. The nature and locations of significant geologic hazards should be considered in the siting of mainline block valves. The applicant should also consider use of automatic or remote-controlled block valves in areas which may be inaccessible following a major earthquake or landslide.

Studies should be done in sufficient detail to allow characterization of the particular geologic hazard using state-of-the-art techniques. Sufficient justification should be included for not implementing specific mitigating measures in areas identified as subject to significant geologic hazards.

10. Additional Mitigation: The topography of the corridor shall be restored to near its original contour.

11. Additional Mitigation: Special methods including the use of padded ditch and heavy wall pipe shall be considered at fault crossings on a site-specific basis.

12. Additional Mitigation: Avalanche hazards may be mitigated by routing the pipeline down stable ridgelines to an elevation where the potential for avalanche damage is not significant.

    Other mitigations for pipeline protection against avalanche hazards shall include encasing the pipe in a protective housing within the avalanche prone areas or deep burial of the pipe in the high mountain avalanche prone areas.

13. Additional Mitigation: The staff recommends utilization of the Wasatch Variation. This would significantly reduce the potential of pipeline rupture and damage to the environment by eliminating segments of the mainline which contain severe slope stability problems.

Summary of Effectiveness Staff Recommended Mitigation Measures: These recommended measures would ensure that the pipeline route would be located in geologically stable areas and the potential for landslides and possible pipeline rupture would be minimized.

4.7.1.3 Soil

Applicant Proposed Measures

General Impact: Loss of topsoil.

14. Mitigation: Selective salvage and replacement of topsoil for agricultural lands and those lands where the landowner requests that topsoil be salvaged and replaced.

    Effectiveness: Decrease potential loss of productivity due to loss of topsoil or mixing of topsoil with less suitable subsoil material.

General Impact: Removal of vegetative cover or desert pavement resulting in increased erosion.

15a. Mitigation: Minimize time interval between clearing, construction, and reseeding.

    Effectiveness: Decreases time bare soil is exposed to erosion, and decreases potential soil loss to erosion.

15b. Mitigation: To limit steepness and length or slopes, erosion control features such as water bars, diversion ditches, terraces, rock mulch (riprap), sand bags, or straw bales would be used.

    Effectiveness: Decrease erosion by water. Effectiveness of mitigation measures will depend upon site-specific design and installation. Intensive application would be needed on steep slopes with high erosion probability in order to effectively stabilize the soil.

15c. Mitigation: Use mulches, where necessary, during the initial stages of reseeding. Rock mulches would be considered where the original surface was coarse, cobbly, or rocky.

    Effectiveness: Decrease erosion wind and water, enhance revegetation by stabilizing soil and conserving moisture.

General Impact: Soil compaction.

16. Mitigation: Preparation of surface to receive seed, including surface roughening and tilling across slopes, ripping, chiseling, or other means of loosening compacted soils and seeding with adapted grass or other plant species.

Effectiveness: Create friable seedbed, improve water intake and permeability, enhance probability of successful revegetation.

General Impact: Reduction in soil productivity.

See Mitigation Measures 14, 15a, 15b, 15c, and 16.

Effectiveness: All of these measures contribute to maintaining soil productivity.

17. Mitigation: Use fertilizers where soil infertility restricts the success of reseeding.

Effectiveness: Improve rate of vegetation re-establishment. Fertilizer will be more likely to obtain a positive response where moisture is not limiting, such as on agricultural lands or higher precipitation zones.

Summary of Effectiveness of Planned Mitigation Measures: The proposed mitigation measures have the capability of controlling erosion within acceptable limits, maintaining productivity and re-establishing vegetation on many areas. Some rangeland soils with loamy, nonsaline/nonalkaline surface layers over hard to soft bedrock, hardpans, saline/alkaline layers, sand, gravel, or cobbles at shallow to moderate depths would have significant revegetation problems if the surface soil is mixed with the subsoil material.

Staff Recommended Measures

General Impact: Loss of topsoil.

18. Additional Mitigation: Selectively handle and replace surface soil suitable for reclamation material when it is underlain by poorly suited or unsuitable reclamation material.

Effectiveness: Probability for successful revegetation will be improved on the affected soils.

General Impact: Accelerated soil erosion.

19. Additional Mitigation: Where practical, locate pipeline on sideslopes of less than 30 percent.

Effectiveness: Water erosion potential will be decreased and probability for successful revegetation will be improved.

20. Additional Mitigation: Fencing of ROW through rangeland to allow undisturbed re-establishment of vegetation. In the absence of recommendations on the locations of crossovers from local land managers or permitees, crossovers shall be located every 500 yards.

Effectiveness: This procedure should allow for re-establishment of vegetation within one to three years, much quicker than would normally occur if grazing were un-checked.

21. Additional Mitigation: Reduce the areas of disturbance to the minimum necessary to construct and operate the pipeline. Avoid particularly sensitive areas prone to significant impact and avoid steep slopes.

Effectiveness: Cumulative impacts would be reduced.

General Impact: Removal of vegetative cover or desert pavement resulting in increased erosion.

22. Additional Mitigation: Reduce the amount of vegetation removed, and where it is removed leave the roots intact.

Effectiveness: Decrease erosion by water and maintain mechanical support within the soil. Minimize the area of disturbance and the area that would require reclamation.

Summary of Effectiveness of Staff Recommended Mitigation Measures: Although the planned and recommended mitigation measures would substantially reduce impacts to soils, a certain percentage of the areas could not be reclaimed to original levels within five years; thus significant impacts would still occur.

4.7.1.4 Surface Water

Applicant Proposed Measures

General Impact: Increased surface runoff, erosion, and off-site sedimentation associated with ROW clearing, construction within, operation, and abandonment of the ROW.

23a. Mitigation: Minimize width of the ROW to that absolutely necessary.

Effectiveness: The potential increase in surface water run-off, erosion, and off-site sedimentation from the ROW would be reduced since the area of disturbance would be reduced.

23b. Mitigation: Minimize the time interval between site clearing and site stabilization.

Effectiveness: The duration of increased runoff, erosion, and off-site sedimentation would be reduced, thereby reducing the cumulative amounts of these impacts.

23c. Mitigation: Use surface runoff and erosion control measures to control and minimize the quantity and potential for significant and sustained erosion and off-site sedimentation. These measures include water bars, hay bales, mulches, and timely stabilization and revegetation of the ROW.

Effectiveness: Greatly reduce the quantities of runoff, erosion, and off-site sedimentation to acceptable levels in most, but not all, situations. The actual response would depend on the intensity and type of measures implemented, and the performance in implementing the measures.

23d. Mitigation: Develop and implement site-specific erosion control, revegetation, and stabilization plans according to BLM, FS, SCS, and other federal and state agency guidelines or criteria.

Effectiveness: Same as for 23c.

General Impact: Reduced water quality, increased sediment loading, and aggradation and degradation of stream channels due to channel bed disruption in response to constructing pipelines through stream channels.

24a. Mitigation: Plans and specifications would be prepared for all stream crossings prior to construction. These plans would include locating stream reaches which would be the least sensitive to pipeline construction.

Effectiveness: This measure would ensure that construction within the stream environment would be planned in advance and hence decrease the potential for significant impact.

24b. Mitigation: Measures to reduce erosion and sedimentation within the stream environment would include:

- Minimizing the area disturbed along or near stream banks to the absolute minimum necessary to complete the crossing and clearing the minimum amount of streamside vegetation,
- Cutting of banks and slopes would be minimized,
- Trench plugging on each side of stream to minimize runoff from trench into the stream,
- Restoring bank to original slope and configuration,

- o Restoration implemented immediately after completion of construction,
- o Restricting debris such as vegetal matter and earth materials from entering the stream.

Effectiveness: These measures would substantially reduce additional sediment loading into the stream and therefore, greatly reduce the potential for significant impact.

24c. Mitigation: Measures to reduce impacts to the stream channel and water quality and quantity include the following:

- o Stream crossings would be made as perpendicular to the axis of the channel as possible,
- o Spoil from trench excavation would be placed out of the stream on the banks at narrow stream crossings,
- o Spoil would be carefully placed downstream of the trench at wide crossings,
- o Backfilling would be performed slowly to minimize agitation and increased sediment loading,
- o Provide good quality backfill for placement in streams,
- o Pipeline buried at least five feet below the channel bed or at a sufficient depth such that scour associated with a 100 year event would not expose the pipeline,
- o Weight the pipeline sufficiently so that exposure due to buoyancy is minimized.

Effectiveness: These measures would greatly reduce the impacts associated with pipeline construction across streams. However, in streams with moderate to high sensitivities due to channel gradients these measures would not be sufficient to reduce impacts to non-significant levels.

24d. Mitigation: Trenching through Las Vegas Wash would be avoided if possible by a directionally drilled installation beneath the channel bed. If directional drilling is not feasible for geotechnical reasons, then a coffer dam would be implemented.

Effectiveness: This measure, if implemented, would essentially avoid all impacts associated with construction through a channel which are generally significant. If a coffer dam was used, a reduction in impact to the stream would occur; however, additional construction would be required beyond a directionally drilled installation within the stream environment. Generally, use of a coffer dam would reduce impacts to non-significant levels.

General Impact: Impacts associated with the withdrawal and discharge of water used in hydrostatic testing of the pipeline.

25a. Mitigation: No stream with an inadequate flow rate would be used as a water source for hydrostatic testing and adequate flow would be maintained for instream uses and downstream withdrawals.

Effectiveness: This measure would minimize significant impact due to substantial dewatering of a stream.

25b. Mitigation: Reuse water for hydrostatic testing wherever possible.

Effectiveness: If feasible, this measure would also greatly minimize the demand for water from streams.

25c. Mitigation: Measures designed to minimize impacts caused by the discharge of water used in hydrostatic testing include the following:

- o Released test water would be discharged into catchments, existing watershed areas, or other approved locations in accordance with requirements of local, state, and federal (NPDES) permits.

Effectiveness: These measures would reduce the potential for scouring, erosion of soils, and reduced stream water quality. However, these measures alone may not be sufficient to reduce potential impacts to non-significant levels.

General Impact: Reduction in water quality due to chemical spillage, and impacts to surface water resources during the operation and abandonment of the pipeline.

26. Mitigation: Chemicals, fuel, and lubricating oils should not be stored near stream channels. Spill containments should be installed or constructed around all chemical, fuel, and oil storage areas. Refueling and changing lubricating oil should not be done in or near stream channels, or where an accidental spill could run into a stream channel or shallow groundwater zone. Any accidental spills should be promptly cleaned up.

Effectiveness: The proposed measure would effectively minimize the potential for significant water quality degradation due to fuel or chemical spillage.

Summary of Effectiveness of Planned Mitigation Measures: The proposed mitigation measures would go a long way toward reducing potential impacts to acceptable, non-significant levels. However, the potential for continued significant impact exists even if the proposed mitigation measures were implemented. The following potentially significant impacts would continue:

a. Not all increased surface runoff, erosion, and off-site sedimentation would be reduced to acceptable, non-significant levels. Additional mitigation beyond the proposed would be required to further reduce these impacts.

b. The proposed measures for crossing streams with moderate to high sensitivities relative to channel gradient would not reduce impacts to acceptable, non-significant levels.

c. The proposed measures for controlling or reducing impacts, such as scouring or erosion, caused by the discharge of water used in hydrostatic pipeline testing would not ensure that impacts would be reduced or controlled to acceptable, non-significant levels.

d. The potential for significant water quality degradation due to increased sediment loading would remain even if the proposed measures were implemented. Surface runoff would be controlled; however, the runoff would apparently not be treated prior to discharge into the streams.

Staff Recommended Measures

General Impact: Not all increased surface runoff, erosion, and off-site sedimentation would be reduced to acceptable, non-significant levels.

27. Additional Mitigation: Intensive surface runoff and erosion control shall be required beyond that proposed on steep slopes that would drain directly into streams. The applicant shall make judicious use of sediment filters, closely spaced water bars, and erosion netting.

Effectiveness: Measures such as sediment filters, closely spaced water bars, and erosion netting are required to further reduce these impacts to non-significant levels. The reclamation potential of some soils on steep slopes may be so poor that stabilization of the disturbed area may take five to ten years to occur. Consequently, even with the most prudent site stabilization techniques implemented, a residual and potentially significant level of impact could continue. Of particular note would be the steep terrain of the Wasatch Mountains.

General Impact: Reduced water quality, increased sediment loading, and aggradation and degradation of stream channels due to channel bed disruption in response to constructing pipeline through stream channels.

28. Additional Mitigation: Coffer dams shall be used for all perennial stream crossings with moderate to high sensitivities due to channel gradient.

Effectiveness: The use of coffer dams would further reduce impacts to the stream environment. Without flow, more attention could be conveniently given to backfilling the trench to meet pre-existing conditions thus minimizing the opportunity of aggradation and degradation. Further, the lack of flow would eliminate most of the sediment disturbed and entrained by flow during excavation and backfilling. Sediment transport would be greatly reduced, thus reducing the potential for significant impact.

General Impact: The proposed measures for controlling or reducing impacts, such as scouring or erosion, caused by the discharge of water used in hydrostatic pipeline testing would not ensure that impacts would be reduced or controlled to acceptable non-significant levels.

29. Additional Mitigation: Water used in hydrostatic testing of the pipeline shall be discharged into an appropriately designed retention pond prior to discharge into the environment in accordance with local, state and federal (NPDES) permits. Retention ponds shall be filled in and returned to pre-construction conditions after use.

Effectiveness: The use of retention ponds would serve to dissipate high energy flows (as high as 5 cfs) during discharge further minimizing potential significant impact caused by scouring.

30a. Additional Mitigation: During pipeline construction contractors shall minimize the time of disturbance and area disturbed. Periods of low flow should be utilized wherever possible.

Effectiveness: The potential increase in surface water runoff, erosion, and off-site sedimentation from the ROW would be reduced since the area of disturbance and the duration of increased runoff, erosion, and off-site sedimentation would be reduced.

30b. Additional Mitigation: After pipeline construction is completed, construction contractors shall stabilize disturbed areas promptly.

Effectiveness: Stabilization of disturbed areas should reduce runoff, erosion, and off-site sedimentation.

Summary of Effectiveness of Staff Recommended Mitigation Measures: The staff recommended mitigation measures would eliminate significant impacts caused by hydrostatic testing as well as impacts to streams in areas with low to moderate relief. However, the mitigation measures could not reduce impacts to insignificant levels on the steep slopes of either the Wasatch or Tehachapi Mountains.

4.7.1.5 Groundwater

Applicant Proposed Measures

General Impact: Potential channeling of groundwater along the pipeline.

31. Mitigation: Bulkheads would be installed on slopes to minimize potential channeling along the pipeline by groundwater that seeps into the backfilled trench.

    Effectiveness: This measure would minimize potential for channeling.

Staff Recommended Measures

General Impact: Effects on springs

32. Additional Mitigation: Identify all nearby springs which serve as sources of water supply or are important to wildlife. Evaluate potential effects of construction and take appropriate precautions to minimize any adverse effects.

    Effectiveness: Possibility of significant impact to important springs would be minimized.

4.7.1.6 Freshwater Biology

Applicant Proposed Measures

No planned mitigation measures were provided by the applicant, although mitigation measures discussed for surface water should reduce impacts to freshwater biology. As with the surface water mitigation measures, significant impacts could occur to streams or steep slope areas. These significant impacts would affect freshwater biological species.

Staff Recommended Measures

General Impact: Increased sedimentation of aquatic habitats

Implementation of sediment control procedures outlined in Section 4.7.1.4.

Effectiveness: Impacts on aquatic organisms would not be significant.

General Impact: Increased turbidity and sedimentation of aquatic habitats.

33. Additional Mitigation: Work backhoes or draglines from the stream banks where possible, to trench any submerged stream crossings.

Effectiveness: Reduced instream disturbance by eliminating the presence of heavy tracked machinery in the stream bed.

General Impact: Disturbed stream banks will result in bank cutting and erosion.

34. Additional Mitigation: Disturbed stream banks shall be restored by replacing topsoil and replanting native riparian species.

Effectiveness: Restoration of disturbed stream banks should improve stability and reduce or eliminate cutting and bank erosion, especially during period of high stream flow.

General Impact: Disturbance to fish species of special concern during spawning seasons in sensitive areas.

35. Additional Mitigation: Impacts to fish species of special concern could be sufficiently mitigated through scheduling construction activities so that they do not conflict with these particular species during spawning seasons. The appropriate state or federal management agency has guidelines defining calendar dates when activity should not occur for the species in question. Scheduling for construction may vary with the environment and climatological circumstances for any given year.

Effectiveness: By scheduling construction activities so as not to conflict with these particular species during spawning, all direct significant impacts to individuals would be resolved.

Summary of Effectiveness of Staff Recommended Mitigation Measures: Implementation of the staff recommended mitigation measures would further reduce impacts.

4.7.1.7 Terrestrial Biology

4.7.1.7.1 Vegetation

Applicant Proposed Measures

General Impact: Loss of vegetation.

36. Mitigation: The applicant would design and implement site-specific revegetation plans according to the requirements and guidelines of the land management agency (BLM or FS) or landowner. These plans would include the necessary topsoil replacement, seedbed preparation, mulching, fertilization, use of seed mixtures containing native species, noxious weed control and additional erosion control. Where the ROW would cross habitat with sensitive wildlife species, such as the San Joaquin kit fox, the ROW should be revegetated with species that annually produce seeds in order to favor granivores, such as kangaroo rats. Generally the revegetation objective would be to return the disturbed area to a condition that would perpetuate pre-vious land use. Guidelines established by the SCS will be used where the pipeline would traverse private land, and if it is agreeable to the owner. Periodic inspection of the ROW would be conducted by the applicant and reclamation efforts enhanced where needed.

    Effectiveness: The successful implementation of a site-specific revegetation plan would greatly reduce the magnitude and duration of impacts to general vegetation for those community types which have a reasonable revegetation potential. Of particular concern would be the success of revegetation within sensitive communities such as known habitat for wildlife species of special concern, agricultural lands, wetlands and riparian zones, and Joshua tree woodland types, as well as in types with poor revegetation potential such as those that occur in the Mojave Desert. Significant impacts to the community types with poor reclamation potential may continue even with the implementation of prudent site-specific plans.

37. Mitigation: During construction the applicant would clear the minimum ROW width possible and minimize ROW damage where possible (e.g., not stripping vegetation less than four inches in height, leaving trees standing and/or mowing taller vegetation as opposed to clearing, the last being particularly desirable in Mojavean shrub communities). Joshua trees under five feet high that cannot be avoided would be transplanted in the winter and spring to an

adjacent area outside of the ROW. Joshua trees over five feet high would be knocked down and piled adjacent to the ROW. The root wads would be covered over with soil. This would encourage resprouting and lessen adverse impacts. Local adjustment of pipeline alignment to avoid areas with high densities of sensitive plant species or sensitive communities would also minimize ROW damage.

Effectiveness: Minimizing ROW width would decrease the acreage of vegetation denuded by construction and lessen the overall cumulative impacts to vegetation types that occur along the proposed route. Additionally, minimizing ROW damage by leaving vegetation standing or mowing where possible would greatly enhance natural revegetation of the ROW.

General Impact: Loss of sensitive plant species individuals or habitat.

38. Mitigation: The applicant would avoid locations of sensitive species and environmentally sensitive areas which include sensitive communities and known and suspected habitat of plant species of special concern. Specific information on sensitive areas would be obtained by conducting field surveys along portions of the proposed route for individuals and habitat of species of concern and sensitive communities. Field surveys would be conducted during the appropriate time of year by a qualified botanist. Where feasible, pipeline alignment would be adjusted to miss or minimize impacts to identified individuals or habitats.

Effectiveness: Realignment of the proposed line to avoid populations or habitats of plant species of special concern as well as sensitive communities would be the most effective method of reducing impacts associated with loss of the sensitive plant species and communities.

Summary of Effectiveness of Planned Mitigation Measures: Proposed mitigation would be generally effective in minimizing impacts associated with removal of vegetation from the pipeline ROW. Additional mitigation to reduce indirect impacts resulting from increased access along the ROW would have to be addressed and are discussed below.

Staff Recommended Measures

General Impact: Loss of vegetation.

39. Additional Mitigation: Restriction of access onto pipeline ROW where possible, by constructing barricades, fences with locked gates or by posting with signs. This would be

especially important for areas supporting sensitive communities or species of special concern.

Effectiveness: Successfully limiting access onto the pipeline ROW would enhance natural revegetation of reclaimed areas in addition to minimizing further destruction of undisturbed vegetation adjacent to the ROW.

General Impact: Loss of sensitive plant species individuals or habitat.

40. Additional Mitigation: Removal of certain sensitive plant species from the ROW may be a way to decrease impacts.

Effectiveness: If all sensitive plant species can be removed prior to construction and be successfully reestablished, no significant impacts would occur. The practicality of the measure would be dependent on the abundance of plants and their ability to withstand transplanting.

Summary of Effectiveness of Staff Recommended Mitigation Measures: Although all of the mitigation measures discussed above would help to minimize impacts to vegetation loss of wetland and riparian vegetation types and scrubland vegetation would still be significant. In addition to general vegetation concerns, loss of plant species of special concern and habitat would still result in significant impacts.

4.7.1.7.2 Wildlife

Applicant Proposed Measures

General Impact: Disturbance to high-interest species, such as game animals and raptors during periods of high stress (i.e., migration, breeding and/or rearing).

No mitigation measures have been planned for this impact.

Effectiveness: Disturbance to high-interest wildlife under the conditions described above would result in significant impacts to individuals and local populations. These disturbances must be alleviated.

General Impact: Disturbance or loss of habitat necessary to sustain high-interest species. This includes but is not limited to habitat utilized as courtship, nesting/rearing areas and wintering areas.

41. Mitigation: Kern River would follow specific procedures for revegetation outlined by the various land management

agencies with jurisdiction over the specific areas impacted.

Effectiveness: This would result in revegetation to pre-existing land use. In the case of big game critical and high priority winter range and elk calving areas, this would result in revegetation of woody plants necessary for browse and cover, respectively. The pipeline company has also stated under maintenance procedures that the ROW would be periodically mowed. Mowing would be in direct conflict with the revegetation of woody species within the disturbed area.

The critical habitat defined for sage grouse breeding/nesting, waterfowl nesting and upland game bird use generally occur on areas with grazing designated as the primary land use. As such, mitigation measures would result in a revegetation of grass species. This would restore disturbed waterfowl nesting habitat and sage grouse breeding habitat, but would not mitigate the loss of shrub species necessary for sage grouse nesting or the cover needed by pheasants and quail in designated critical use areas. If shrub species were incorporated into the revegetation scheme in these habitats, it would conflict with the pipeline company's maintenance procedure that prescribes periodic mowing of the ROW.

General Impact. Disturbance to any species of special concern (federal and/or state listed or candidate species, BLM sensitive species and wild horses and burros).

42a. Mitigation: Kern River would avoid environmentally sensitive areas, such as known habitats for threatened and endangered species, wherever possible.

Effectiveness: Although avoidance of environmentally sensitive areas provides the best possible mitigation measures for species of special concern, in some cases it is not feasible. Many sensitive species have relatively wide distributions in the vicinity of the proposed line and avoidance is impossible. In many cases, precise information is lacking on sensitive areas within these species' distribution. Some species are present in a habitat site only at certain times of the year, and in such cases, total avoidance of a sensitive habitat is not necessary.

42b. Mitigation: Kern River plans to conduct surveys to identify active prairie dog colonies in the area of the proposed pipeline. Where active colonies are found to be impacted by the proposed route, further surveys by a qualified biologist would be completed to determine the presence or absence of black-footed ferrets. Such surveys would be done within a year of initial pipeline construction.

Effectiveness: This mitigation effort would be sufficient to identify any ferret population along the proposed route and would allow the company time to plan alternative routing if ferrets are identified.

Summary of Effectiveness of Planned Mitigation Measures: Disturbance to high-interest species during periods such as migration, breeding and/or rearing would be significant and should be mitigated. Kern River has not developed any measures to alleviate impacts to these species.

If mitigation measures replaced the pre-existing community in kind, revegetation would be sufficient to ameliorate destruction of habitat deemed necessary for high-interest species. If habitat was not replaced in kind, the carrying capacity of the habitats would change over the life span of the project, potentially reducing populations in the affected area.

Planned mitigation efforts to ameliorate impacts to species of special concern by avoidance of sensitive areas may not be practical. Field surveys, as presently planned for ferrets, should first be conducted to identify specific high-sensitivity sites that may then be avoided spatially or temporally. Other measures are available to mitigate losses to certain species such as the desert tortoise.

Staff Recommended Measures

General Impact: Disturbance to any species of special concern and high-interest species, such as game animals and raptors during periods of high stress (i.e., migration, breeding and/or rearing and hibernation/aestivation).

43. Additional Mitigation: Impacts to high interest species could be sufficiently mitigated through scheduling construction activities so that they do not conflict with resident wildlife during times of high stress. The appropriate state or federal management agency has guidelines defining calendar dates when activity should not occur for the species in question. Scheduling for construction may vary with the environment and climatological circumstances for any given year.

    Effectiveness: By scheduling construction activities so as not to conflict with these particular species during stress periods, all direct significant impacts to individuals would be resolved.

General Impact: Loss or disturbance of habitat utilized by species of special concern. This includes any designated critical habitat of proposed or listed threatened or endangered species, or loss or disturbance of greater than one percent of habitat supporting a viable population of species of special concern.

44. Additional Mitigation: Revegetate all disturbed habitat deemed necessary to high-interest species to predisturbance levels.

Effectiveness: Revegetation in kind would ameliorate all important habitat disturbances. A short-term impact would remain for the time it takes for revegetation efforts to come to fruition.

45. Additional Mitigation: The applicant shall conduct field surveys to identify environmentally sensitive areas, such as nest sites, winter roosts, or habitat that supports viable populations of species of special concern. The applicant shall avoid these areas where possible.

Effectiveness: By identifying sensitive habitats and habitat components, the applicant could then avoid such sites and minimize potential impacts. Avoidance of specific habitat components, such as bald eagle winter roost sites, is necessary to insure the quality of habitat. These habitat components are generally traditional in nature, and limited in quantity and spatial distribution.

General Impact: Disturbance to any species of special concern (federal and/or state listed or candidate species, BLM sensitive species and wild horses and burros).

46a. Additional Mitigation: Conduct field surveys as required by the FWS for species of special concern in order to identify precise locations of sensitive habitats.

Effectiveness: By identifying sensitive habitats, Kern River would then be in a better position to determine routing that would avoid these sites. In many cases, total avoidance would be impossible. Field surveys would permit management the opportunity to choose routing that would have the least impact on these species. Some sensitive sites would be utilized only during a particular time of the year. In these cases, construction activities could be scheduled to avoid direct conflict with the species in question. Certain species aestivate and/or hibernate. Field surveys that identified concentrations of such species would enable management to schedule construction in these areas so that dormant animals would not be trapped and killed in their burrows. No mitigation effort would completely ameliorate all significant impacts, especially to small federally listed candidate species.

46b. Additional Mitigation: Limit construction activities in areas of desert tortoise concentrations to the hibernation period between October and April. Employ qualified biologists to conduct tortoise searches within the impacted area immediately before construction so that hibernating and/or active individuals may be removed from the path of construction.

Effectiveness: This mitigation measure is a brief description of a detailed methodology developed for the All American Pipeline Project [Reyes-French, 1985]. If this mitigation plan were to be followed, tortoise losses would likely be kept to a minimum. However, use of the construction windows listed above would conflict with protection of the Mojave ground squirrel.

General Impact: Disturbance to high interest species such as game animals and raptors during periods of high stress such as migration, or breeding.

47. Additional Mitigation: A competent wildlife biologist shall survey for all potential raptor nesting habitats within 0.5 mile of the pipeline prior to construction. No construction will occur between 0.5 mile of active nests in the nesting period (March 15 to July 15).

Effectiveness: This measure would alleviate significant impacts relating to disturbance of raptors during nesting.

General Impact: Disturbance to any species of special concern, including federal or state listed or candidate species and BLM sensitive species.

48a. Additional Mitigation: Survey all potential desert tortoise habitat along the pipeline route and include the results of the survey in the project planning process to minimize construction-related impacts to the species. Construction procedures shall include restricting construction to between October and April when the tortoise are hibernating. A competent tortoise biologist shall survey the proposed route immediately in advance of construction equipment and remove active and/or hibernating tortoise and move them to another burrow or hibernaculum outside the construction ROW. Injured or dead tortoise shall be handled and/or disposed of according to Memorandum of Understanding with state fish and game agencies and the U.S. Fish and Wildlife Service (Utah) with and funds provided by the applicant for rehabilitation and return of the tortoise to their home range.

Effectiveness: This mitigation is consistent with mitigation measures presented in a detailed methodology developed for the All American Pipeline Project to minimize loss of desert tortoise [Reyes-French, 1985] and would address concerns regarding this impact.

48b. Additional Mitigation: Limit the length of open trench in desert bighorn sheep areas, skip sections of trench or provide temporary bridges where more than 0.5 mile of trench would remain open for extended periods of time.

Effectiveness: This mitigation measure would help reduce disturbance of the animals and loss or injury of animals from falling in open trenches.

48c. Additional Mitigation: Surveys shall be conducted by the applicant to determine the distribution of San Joaquin kit fox and blunt-nosed leopard lizard habitat in areas of the San Joaquin Valley that would be traversed by the proposed pipeline. Rerouting of the pipeline shall be evaluated and done where possible and in areas where the habitat of the two species must be crossed, the width of the construction ROW shall be restricted to 50 feet. Pipeline alignment shall be adjusted to avoid dens within the construction ROW. No construction shall be done in San Joaquin kit fox habitat during pupping season (March-May) and revegetation plans should include measures to promote reestablishment of plant species that annually produce seeds, in order to favor populations of kangaroo rats, which are the kit fox staple food.

Effectiveness: Avoidance of habitat is the best possible mitigation relating to reducing impacts to species of special concern. Where not possible conservation measures presented by the applicant and additional measures recommended by the staff would help to minimize losses of San Joaquin kit fox as a result of construction activity.

General Impact: Loss of individuals of any species of special concern, including federal and/or state listed or candidate species and BLM sensitive species. Disturbance that results in a reduction in recruitment to their populations.

49a. Additional Mitigation: Construction activities in the vicinity of established or suspected migration corridors for big game species shall be timed so as not to conflict with animals during migration. The appropriate state or federal management agency shall be contacted to establish calendar dates which would define the time of construction that would minimize impacts due to disturbance.

Effectiveness: Timing of construction activities as not to conflict with periods of migration would reduce stress on individual animals by allowing free movement between ranges.

49b. Additional Mitigation: Public access into habitat of species of special concern shall be controlled.

Effectiveness: Eliminating access to critical habitat of species of special concern would reduce stress on animals and destruction of habitat associated with use of ORVs on the pipeline ROW.

49c. Additional Mitigation: Surveys of the proposed pipeline ROW shall be conducted in areas providing habitat for federally proposed or listed species.

Effectiveness: By identifying species habitat possible mitigation could be implemented to reduce impacts to these species.

49d. Additional Mitigation: Where the ROW would cross habitat with sensitive wildlife species, such as the San Joaquin kit fox, the ROW shall be revegetated with plant species that annually produce seeds in order to favor granivores, such as kangaroo rats.

Effectiveness: Revegetation with seed producing annuals would provide food and cover for species and thus return the ROW to pre-construction levels.

49e. Additional Mitigation: Construction activities for threatened or endangered species shall be timed to not conflict with crucial time periods such as hibernation. This would apply to the blunt-nosed leopard lizard but not to the desert tortoise where construction during hibernation is desired.

Effectiveness: Timing of construction activities to not conflict with crucial time periods would reduce chances of causing impact.

49f. Additional Mitigation: Trenches shall be inspected daily for species of special concern that might have fallen into the trenches. Any species of special concern found should be handled in accordance with prearranged agreement with the appropriate agencies.

Effectiveness: Trench inspection on a daily basis would reduce impact to species which have fallen into the trench to zero.

49g. Additional Mitigation: In San Joaquin kit fox habitat, establish temporary artificial barriers 35-50 feet from washes to minimize potential chemical contamination from surface runoff.

Effectiveness: Temporary artificial barriers around washes would help to protect critical wildlife habitat and would reduce impacts to all species.

49h. Additional Mitigation: Limit speed of vehicles along the ROW and access roads to 15 mph in sensitive habitats that support species of special concern with limited home ranges and mobility, e.g., the blunt-nosed leopard lizard and the desert tortoise.

Effectiveness: Speed limits during the construction and periodic inspection and maintenance phases would minimize the chance of animal/vehicle collisions.

Summary of Effectiveness of Staff Recommended Mitigation Measures: Scheduling construction activities to avoid conflict with high-interest animals at critical periods of their life cycle would eliminate the direct significant impacts to individual animals.

Revegetation measures may fall short of replacing vegetation communities to pre-construction conditions. Because only a small percent of big game critical and high priority winter range would be disturbed, these results may have only a limited affect on big game populations. If the ROW was revegetated and maintained in grasses, additional edge habitat would be created in these big game ranges. Edge habitat is an important component in wildlife communities providing feeding opportunities near secure cover. Creating edge habitat is beneficial to general wildlife communities, but may not be sufficient to offset the loss of needed browse and cover. Failure to replace woody vegetation in critical upland bird habitats would be a serious concern because of the loss of significant amounts of limited cover necessary for their survival.

Identifying and avoiding sensitive sites for species of concern would reduce and, in some cases, eliminate impacts to these species. For many of these species the possibility of direct mortality to individuals is still likely and probably unavoidable. Field studies that identify concentrations of these species would permit avoidance of high density areas resulting in a reduction in losses. Conservation measures efforts outlined above for the black-footed ferret and the desert tortoise would provide adequate measures to alleviate concern for these species.

4.7.1.7.3 Grazing

Applicant Proposed Measures

See Mitigation Measure 37.

Staff Recommended Measures

See Mitigation Measure 20.

General Impact: Loss of 5 percent or more of carrying capacity on an allotment traversed by the proposed pipeline alignment.

50. Mitigation: Revegetate the ROW so that pre-project grazing opportunity levels are re-established.

Effectiveness: Minimizes the period when AUMs are lost.

General Impact: Broken fences and disruption of natural and artificial barriers to livestock needed to maintain separation and control of livestock.

51. Additional Mitigation: Maintain livestock separation and control during construction, repair fences and maintain livestock separation and control devices such as cattleguards, gates, drift fences and natural barriers to equal the effectiveness of the existing control structures prior to pipeline construction or operation.

Effectiveness: Restores livestock control facilities to pre-project level.

General Impact: Although no significant impacts were noted along the proposed routes, the potential exists for significant impacts to occur under certain scenarios. The most likely scenario would involve the failure of revegetation or soil erosion control efforts thereby necessitating the fencing of the ROW. This would isolate portions (>5%) of a given allotment for three to five years to allow revegetation to occur. In addition, adverse impacts may occur that do not initially meet criteria for being significant but have the potential for being significant if left unchecked. The reader is referred to the relevant mitigation measures proposed by the applicant in the soil and vegetation sections (4.7.1.3 and 4.7.1.7, respectively). The following discussion is directed at avoiding impacts as well as mitigating losses if they occurred.

52. Additional Mitigation: The following sequence of action is proposed, in order of preference:

- re-scheduling of pasture rotation so that affected pasture is allowed more time to revegetate
- not using an allotment and reallocate the affected AUMs to other unused or under-used allotments

- removal of livestock from affected allotments for three to five years with compensation to the permittee

Effectiveness: By shifting grazing pressure away from the affected ROW within a given allotment, revegetation efforts would have a greater possibility of succeeding. Once the ROW is revegetated, the adverse significant impact would be eliminated.

53. Additional Mitigation: If none of the mitigation measures are effective, feasible or available and revegetation of the ROW is of major importance to the managing agency, the ROW shall be fenced for at least three to five years. In some cases, a 50 foot crossover strip placed every two miles would be feasible.

Effectiveness: By eliminating grazing pressure and associated activity along the adversely affected portion of the ROW within a given allotment, revegetation efforts would succeed and the adverse impact eliminated. Use of cross-over strips would allow use of both sides of an allotment separated by the ROW and thereby reduce loss of carrying capacity.

Summary of Effectiveness of Staff Recommended Mitigation Measures: Mitigation measures for grazing should effectively mitigate long-term impacts to grazing.

4.7.1.8 Socioeconomics

Applicant Proposed Measures

No planned mitigation measures were provided by the applicant.

Staff Recommended Measures

General Impact: Housing shortages and effects on tourism may occur due to construction workers needs.

54. Additional Mitigation: Construction of the pipeline and other related facilities shall be scheduled to avoid peak tourist seasons in the affected area if possible. Implementation of this measure will minimize the pressure on housing supplies in these tourist areas.

55. Additional Mitigation: In rural areas along the Kern River Pipeline route, workers would need to seek housing and services in larger, more distant communities. Project employees may be able to travel to and from construction areas together. Implementation of this measure would concentrate project-related housing demands in developed areas where accommodations are available, thus alleviating

pressures on small communities and reducing the individual commuting time.

56. Additional Mitigation: To further mitigate housing impacts in rural areas or in crowded tourist areas, workers may be able to reside in temporary trailer camps. Work camps would mitigate pressures along the entire route. Implementation of this measure would also permit small communities with limited services to benefit from employee expenditures for food and supplies while residing in their own temporary accommodations.

Summary of Effectiveness of Staff Recommended Mitigation Measures: Implementation of the mitigation measures outlined should effectively reduce socioeconomic impacts.

4.7.1.9 Land Ownership/Use

General Impact

The pipeline companies must comply with or conform to all administrative agencies, plans, policies, and regulations and negotiate with private land owners if a land use conflict is identified.

Uinta National Forest would need to amend its Land and Resource Management Plan to allow the Kern River Mainline or the West Strawberry Variation to traverse its land. The BLM resource areas of House Range, Warm Springs, and Cedar-Beaver-Garfield-Antimony would need to amend their Resource Management Plans to establish another utility corridor. The Sunrise Mountain ISA status would have to be changed before the pipeline could be constructed. The Rainbow Gardens Natural Area designation would have to be changed before the pipeline could be constructed. The Master Plan of Clark County Wetlands Park would need to be amended to allow pipeline construction and operation. The land use plans would need to be changed for the cities of Henderson and East Las Vegas, and negotiation with the private landowners would be necessary. Wasatch-Cache National Forest would need to amend its Resource Management Plan.

Applicant Proposed Measures

No planned mitigation measures were provided by the applicant.

Staff Recommended Measures

See Staff Recommended Measures in Section 4.7.1.13.

57. Additional Mitigation: The applicant shall utilize the North Las Vegas Variation.

Effectiveness: Utilization of the North Las Vegas Variation would avoid crossing the Sunrise Mountain ISA, the Rainbow Gardens Natural Area and the Clark County Wetlands Park. It would also avoid conflicts with the city of Henderson, Nevada, thus avoiding conflicts with land use plans. It may conflict with the Moapa River Indian's preference to avoid their reservation; however, there is an existing energy transmission corridor that crosses the reservation.

4.7.1.10 Cultural Resources

4.7.1.10.1 Archaeology

Applicant Proposed Measures

58. Mitigation: Impacts to cultural resources would be mitigated following procedures developed by the Advisory Council of Historic Preservation (ACHP), as specified in 36 CFR 800. This would require:

- an intensive survey of the selected ROW, construction areas, and access roads,
- an evaluation of identified resources for eligibility for the National Register of Historic Places, in consultation with the appropriate State Historic Preservation Officer,
- determinations on effect on eligible properties in consultation with ACHP, and
- implementation of prudent and feasible measures to avoid or reduce adverse impacts.

Effectiveness: In developing the mitigation plan, avoidance of impacts is the preferred option, as other mitigation measures generally entail the partial destruction of the resource. Where avoidance is not possible, data recovery mitigation may reduce impacts to an acceptable level.

Staff Recommended Measures

General Impact: Disturbance to cultural resources could occur along the proposed route.

The FERC and SLC prepared a Cultural Resource Technical Report for the various projects (including alternative routes) pursuant to 36 CFR Part 800.4(a) of the new regulations of the Advisory Council on Historic Preservation (ACHP). A draft version of the Technical Report was circulated in September 1986 to the various

SHPOs, ACHP, BLM, Forest Service, Bureau of Indian Affairs, and the Navajo Nation. Comments were received and incorporated into a revised Technical Report which will be recirculated for appropriate agencies' use as part of the compliance process for Section 106 of the National Historic Preservation Act. As stated in the Introduction to Volume I of this EIR/EIS, this Technical Report is not distributed to the public. The salient information, however, is summarized in the EIR/EIS. The Technical Report, while not required in order to comment on the EIR/EIS, will assist the SHPOs in the compliance process as recommended below.

59. Additional Mitigation: Based on the Cultural Resource Technical Report, the regulations at 36 CFR Parts 61.2, and the new ACHP regulations at 800.4 (a) (ii) and 800.4 (b) published in the Federal Register on September 2, 1986 (51 FR 31115), the applicant(s) receiving FERC certification shall contact the appropriate SHPO(s) for assistance in evaluating additional information resources which should be consulted and their recommendations for further surveys to enable the certificated applicant(s) to assess the eligibility of those properties currently identified in the Technical Report and identify any additional eligible or National Register properties. The certificated applicant(s) shall consult these resources and furnish the results of the assessment, along with the SHPO's recommendations for field surveys to the FERC staff.

A cultural resource management plan shall then be designed by the applicant in consultation with the FERC, the SHPO(s), and other appropriate agencies including, on federal lands, BLM, the Forest Service, Bureau of Indian Affairs, and the Fish and Wildlife Service, as necessary. The management plan would outline procedures and methods to identify, evaluate, and protect (i.e., through avoidance or scientific data recovery) National Register and eligible properties. Appropriate research questions shall be included in the plan, although others may develop as the field investigation studies proceed. Guidelines for mitigation of impacts to resources that are not avoidable shall be included in the cultural resource management plan.

Consideration shall be given to a monitoring program for ground-disturbing activities in areas where cultural resource inventory indicates a likelihood that resources not now evident on the ground surface are likely to occur as buried resources. Such an "emergency discovery" program shall be consistent with the ACHP regulations at 36 CFR Parts 800.5 and 800.11 (a).

Prior to project construction, but after the formulation of the management plan, the applicant shall design and conduct an intensive cultural resource survey where necessary equivalent to a BLM Class III pedestrian survey of any previously uninventoried lands crossed by the final pipeline route and ancillary facilities. This survey shall be done in consultation with appropriate Native American groups to help identify resources of traditional Native American value.

Upon completion of the field surveys, the applicant shall identify for the FERC and appropriate SHPO(s) all cultural properties potentially affected by the undertaking, and how each property addresses either the research questions in the management plan, or other National Register criteria of eligibility, and the applicant's opinion of the effect of the project on any properties. Once properties are properly identified and recorded, the FERC staff, in consultation with the SHPO(s), will identify National Register properties by applying the National Register criteria of eligibility in light of the research questions developed for the management plan, new research questions inherent in the data, or other criteria under 36 CFR 60.4. Additional information concerning the resources would be obtained by the applicant if required by the FERC staff to apply those criteria.

Cultural resources determined eligible for inclusion in the National Register shall then be evaluated as to the impacts of the project. A determination of effect shall be made by the FERC staff in consultation with the appropriate SHPO(s) pursuant to 36 CFR Part 800.5. Indicators for determining the potential effect of construction on cultural resources are set forth in the ACHP regulations at 36 CFR Part 800.9.

If it is determined that effects upon National Register or eligible properties would occur as a result of the project, a mitigation plan to reduce or eliminate these effects shall then be formulated. Site-specific mitigation plans shall be formulated in accordance with the appropriate provisions of the management plan. An modification of the management plan deemed necessary in light of discoveries made during the field surveys shall also be identified. The mitigation plans shall discuss the timetables for completion of the final report for the phases of mitigation associated with data recovery, laboratory analyses and artifact curation. The final report shall document the method, theory, and results of implementing the mitigation plans. The final report shall be submitted to the FERC and the appropriate SHPO(s) upon completion in accordance with the identified timetables.

If properties on or eligible for the National Register would be affected, the FERC shall afford the ACHP an opportunity to comment on the effects of the project and the proposed mitigation plans.

Until the FERC staff has informed the applicant(s) in writing that the ACHP has provided the FERC with its comments pursuant to Section 106 of the National Historic Preservation Act and the applicant(s) has agreed to any modifications of the mitigation plan which the ACHP and the FERC staff have agreed upon, the applicant(s) may not proceed with implementation of the mitigation plans or with construction.

4.7.1.10.2 American Indian Concerns

The Moapa River Indians prefer that the pipeline avoid their reservation land and may object to the North Las Vegas Variation. If necessary, a realignment of the North Las Vegas Variation could be done.

60. Additional Mitigation: Tribal plans for cultural resource preservation shall be followed on tribal lands. In general, sacred and archaeological sites shall be avoided whenever possible, burials shall be left undisturbed, and care be taken to avoid the destruction of traditionally used plants and animals. Artifacts recovered from archaeological excavation shall be returned to the tribe if found on tribal lands.

Summary of Effectiveness Staff Recommended Mitigation Measures: These additional mitigation measures should adequately mitigate the adverse effects to cultural resources and Native American concerns.

4.7.1.11 Paleontological Resources

Applicant Proposed Measures

No planned mitigation measures were provided by the applicant.

Staff Recommended Measures

General Impact: Loss or disturbance of paleontological resources could occur along the pipeline route.

61. Additional Mitigation: The following describes measures designed to avoid or mitigate potentially adverse effects to paleontological resources resulting from construction of the proposed project that should be implemented by the applicant. Implementation of this program should reduce damage to, or destruction of, significant fossils as a result of bedrock disturbances during construction operations. This program should include pre-construction measures and monitoring of sensitive areas during construction operations.

    Pre-Construction. Those areas identified as being of high paleontological sensitivity shall be examined prior to construction to determine the precise nature and location of fossils previously discovered within one mile of the pipeline route. Attention shall be directed toward identifying sections of these corridors where construction would result in bedrock disturbance adjacent to localities known to yield significant fossils. An initial pre-construction evaluation shall be made by comprehensively reviewing pertinent published paleontological literature, museum fossil locality records, and by requesting additional locality data from paleontologists who are engaged in active research in these areas.

A pre-construction surficial field inventory may then be recommended for those parts of the 100 foot-wide pipeline construction corridor where disturbance of fossils may occur. The purpose of this inventory should be to evaluate in more detail the significance of local fossils by identifying the fossil types present, ascertaining their quality of preservation, and determining more precisely their extent and distribution. At some localities, small, shallow trenches may be excavated to facilitate these observations.

If it is found that significant fossils could be adversely affected, appropriate site-specific mitigation measures shall be designed. These measures may include the controlled scientific removal of fossils that would otherwise be damaged or destroyed during construction. Any such removals shall be made by professional paleontologists authorized by the appropriate federal, state, and county collecting permits. In accordance with these permits, all fossils shall be placed in appropriate repositories, with records of their precise locality, and descriptions of the geological and faunal context of each. This survey shall also determine whether additional mitigation measures be implemented during construction activities.

Construction. Mitigation measures that may be implemented during construction include monitoring construction activities in which bedrock would be disturbed. This may entail inspection of cleared and graded sections of the corridor before trenching, and inspection of the rock excavated from the trench before burial of the pipe.

Procedures shall be established and approved by permitting agencies for temporarily halting or redirecting construction if fossil accumulations are encountered during construction. An approved paleontologist, contracted to implement the management plan, shall be notified immediately upon encountering a chance fossil find so that the significance of the find can be evaluated efficiently and, if necessary mitigation actions taken.

If significant fossils are encountered during construction, their controlled scientific removal from the construction site may be necessary. Removal of fossils discovered during construction shall be implemented by professional paleontologists in accordance with professionally recognized standards.

Summary of Effectiveness of Staff Recommended Mitigation Measures: These mitigation measures should effectively reduce impacts to paleontological resources to insignificant levels.

4.7.1.12 Visual Resources

Applicant Proposed Measures

No planned mitigation measures were provided by the applicant.

Staff Recommended Measures

General Impact: Degradation of visual resources could occur along the pipeline route.

62. Additional Mitigation: The applicant shall implement three generic types of mitigation techniques: 1) strategic location, 2) minimization of disturbance, and 3) repetition of basic landscape elements (form, line, color, texture). Mitigation recommendations described below, based on these techniques, will reduce visual contrasts of the project facilities.

Construction: During construction, clearing of land for facilities or structures should create curvilinear boundaries instead of straight lines and minimize marring and scarring of the landscape to the greatest practical extent. Grading shall be done in a manner which will minimize erosion and conform to the natural topography [USFS, 1977].

Cleared brush or small trees not otherwise disposed of shall be piled in a way that provides cover habitat for small mammals, reptiles, and birds. Such brush piles shall be screened from public view to the greatest practical extent [Robinette, 1973].

Soil and rocks that are excavated but not used during construction shall be evenly spread onto the cleared area or removed from the site. Soil and rocks shall be graded to conform with the terrain and the adjacent land.

Compressor Stations: The colors selected for the compressor stations, and other structures and facilities shall be based on the following considerations [Robinette, 1973]:

- The colors shall be uniform and noncontrasting to blend with the immediate natural environment. The warmest color tones are appropriate for natural settings.
- Exposed concrete shall be tinted to match the soil color.
- Colors shall be selected on the basis of their ability to blend with both the sky and the environment in which they are being used.
- Colors that reflect adjacent colors by including them are most successful in adapting to their environment and shall be utilized.
- Colors approved in the Munsell Soil Color Coding System and displayed on the Standard Environmental Color Chart shall be considered.

Overhead Electrical Powerline to Compressor Stations:

- Towers or poles shall be placed strategically to make maximum use of existing topography and vegetation for screening.
- Electrical powerlines shall be located at the base of slopes when feasible to provide a background of topography and/or natural cover.
- Materials used to construct towers or poles shall harmonize with the natural surroundings. Where natural wood poles are appropriate, the color range shall be limited to present unified series of poles.
- Choice of conductor material shall be carefully considered to avoid sheen or a strong silhouette and to provide blending of the conductors into any given setting through which the line must pass.
- When lines are adjacent to roads, guyed towers shall be avoided whenever possible.

63. Additional Mitigation: Landscape-type Measures

Mitigations are identified in three broad categories: landscape type mitigations, distance zone mitigations, and performance mitigations. In general the mitigation of vegetation and soils impacts are the only reasonable mitigation for visual impacts as well.

See Mitigation Measures 10 and 21.

Special cases may include high impact areas where specific concern from citizens and/or land management agencies have indicated detailed visual analysis and mitigation measures be developed. These would be developed on a case-by-case basis.

63a. Grading and earthwork

Minimize routing pipeline along prominent ridgelines.

63b. Riparian (streams, rivers, and washes). When providing access to the pipeline right-of-way, rivers, streams and washes shall be crossed at existing roads or bridges when present; any other crossing must be approved and designated by the land managing agency. All stream channels and washes shall be returned to their pre-construction state. Such construction, when it would occur, shall be managed under the restrictions in the current BLM manual and/or Department of Interior policy direction. Mitigation measures required include:

- Installation of culverts or bridges at points where new permanent access roads would cross live streams to allow unobstructed fish passage,
- Where drainages would be crossed by temporary roads, dirt fills, or culverts shall be placed and removed upon completion of the project,
- Construction activity in a perennial stream shall be prohibited so long as other alternatives exist unless specifically allowed by the BLM and/or FS.

63c. Forested Areas. Several different types of forest ecosystems are encountered at the higher elevations along the various pipeline routes, and although they have differing species, they can be treated uniformly and the mitigation measures are virtually identical. Measures should include:

- Leave trees as close to the downhill side of the ROW as possible,
- Create as few landings and turnouts as possible, and do not locate them on the noses of ridges or exposed slopes,
- Avoid grade changes as much as possible.

64. Additional Mitigation: Distance Zone Measures

Foreground View. A foreground view is determined to be the detailed view from between 0 to 1/4-1/2 mile from the viewer. Visual impact appearing in a foreground view shall be obscured, concealed, or disguised through screening or controlling access to views.

Middleground and Background View. Views beyond 1/2 mile shall be mitigated by revegetation techniques to blend the impact back into the surrounding environment, utilizing landscape texture, color, and pattern to subordinate the impact and soften the edges.

65. Addition Mitigation: Performance Measures

In order to meet the Forest Service VQO and the BLM VRM objectives, certain time limitations shall be established within which mitigation measures must occur to reduce visual impacts upon the existing environment.

Summary of Effectiveness of Staff Recommended Mitigation Measures: Utilization of the mitigation measures outlined above would result some residual adverse impacts following application of the appropriate mitigation measures, particularly in portions of the Uinta National Forest in Utah and around Keany Pass in the Clark Mountain area of southeastern California.

4.7.1.13 System Safety and Reliability

Applicant Proposed Measures

Safety aspects of pipeline design and operation are governed by federal regulations as summarized in Section 4.2.13.3. Kern River has reiterated in their application that they will conform to all the requirements of these regulations.

Staff Recommended Measures

See Mitigation Measures in Section 4.7.1.2.

66. Additional Mitigation: Aircraft monitoring of the pipeline ROW for operation and maintenance purposes should be coordinated with nearby military installations, e.g., Edwards AFB, in order to avoid potential conflict.

- Select the pipeline route to avoid populated areas both from a land use and public safety perspective. In particular, the following areas should be avoided if possible:
  - The residential areas near Henderson and East Las Vegas, Nevada, can be avoided by selection of a route such as the primary route proposed by Kern River.

The North Las Vegas Variation would avoid this area. The Henderson Variation bypasses some of the residential area but not all. The staff recommends use of the North Las Vegas Variation.

- The scattered residences in the Juab Valley traversed by the Salt Creek Canyon Variation shall be avoided by the selection of the primary route through this segment.
- The route through Bakersfield shall be carefully selected to avoid or minimize impact on areas zoned residential or recreational.

4.8 UNAVOIDABLE ADVERSE IMPACTS

4.8.1 Kern River Proposal

Implementation of the mitigation measures presented in Section 4.7 would reduce the impacts associated with the Kern River Proposal and the variations and alternatives. Those significant impacts that would remain following mitigation are presented in Table 4.8-1. Only those disciplines with significant impacts prior to mitigation will be included in the table.

4.8.1.2 East Las Vegas System Alternative

Implementation of mitigation measures presented in Section 4.7 would reduce the impacts associated with this system alternative. Unavoidable adverse impacts however would still occur in all of the disciplines noted in Table 4.8-1.

4.8.1.2 East Las Vegas System Alternative with the Wasatch Variation

Similar impacts to those discussed above would occur for this alternative. The affects on geology, however, would probably not result in an unavoidable adverse impact.

4.8.1.3 Northwest/PGT/Integrated Intrastate System Alternative

Implementation of mitigation measures presented in 4.10.3 and 4.10.5 of Volume I for El Paso and Transwestern respectively would reduce the impacts associated with the alternative. The significant impacts that would remain following implementation of the mitigations are presented in Tables 4.11.3 for El Paso and 4.11.5 for Transwestern.

Table 4.8-1

SIGNIFICANT ADVERSE IMPACTS, KERN RIVER PROPOSAL

Discipline	Significant Impact	Mitigation Measures 1/	Effectiveness	Residual Significant Impact
GEOLOGY Construction and operation	Significant impact caused by slope instability and avalanche could occur in Wasatch Mountain portion of mainline and the Tehachapi Mountains	4, 5, 7, 9, 10, 12 and 13	If information were applied to locate the pipeline in areas of least danger, potential problems would be minimized	Yes
	Significant impact caused by hydrocompaction could occur in the Mettler area and within the San Joquin Valley	6	Reduce hydrocompaction potential to minimal levels	No
	Potential ground rupture at fault crossings including Wasatch, Garlock and White Wolf	4, 5, 8, and 11	Ground motion parameters will be developed and used in seismic design of the pipeline and ancillary facilities	No
SOILS Construction and operation	Significant water erosion of soils could occur along portions of the route between Wyoming and California. Highest potential would occur in areas traversing mountains or steep hills	14, 15a, 15b, 15c, 16, 17, 19, 21 and 22	Water erosion potential will be decreased and probability for successful revegetation will be improved	Yes
	Significant wind erosion of to soils could occur along all portions of the route particularly in the Mojave Desert	15a, 15c, 16, 17, 18, 20, and 22	Probability for successful reclamation will be increased	Yes
SURFACE WATER Construction and operation	Significant impacts caused by hydrostatic test water discharge could occur	25a, 25b, 25c, 26, and 29	Scouring would be minimized at discharge site. Sedimentation to streams would be decreased	No
	Significant impacts caused by increased sediment loading could occur particularly in steep terrain in the Wasatch and Tehachapi Mountains	23a, 23b, 23c, 23d, 24a, 24b, 24c, 24d, 27, 28, 30a and 30b	Impacts could be reduced, but steep slopes would remain as severe reclamation problem areas and some sedimentation would still occur	Yes
GROUND WATER Construction and operation	Possibility of significant impacts to groundwater caused by contamination due to fuel or chemical spills in shallow groundwater areas	31 and 32	Reduce potential for spills and avoid shallow groundwater areas	No
	Possible adverse impact on springs	32	Damage to important springs due to blasting and grading would be minimized	

1/ Numbers refer to mitigation measures listed in Section 4.

Table 4.8-1 (continued)

SIGNIFICANT ADVERSE IMPACTS, KERN RIVER PROPOSAL

Discipline	Significant Impact	Mitigation 1/ Measures	Effectiveness	Residual Significant Impact
FRESH WATER BIOLOGY Construction and operation	Potential significant impacts could occur from construction activities at 13 stream crossings in the Middle Rocky Mountains region, particularly the Provo River and Beaver Creek which cross habitats of sensitive species	33, 34 and 35 in addition to measures outlined for surface water	Impacts could be reduced, but steep slopes would remain as severe reclamation problem areas and some sedimentation would still occur	Yes
TERRESTRIAL BIOLOGY Construction and operation	Loss of wetland and riparian zone vegetation would occur along portions of the entire route particularly the Strawberry, Bear and Weber Rivers in Utah and Las Vegas Wash in Nevada	36, 37 and 38	Successful reclamation would greatly reduce the magnitude of impacts.	No
	Loss of plant species of special concern and habitat could occur along the entire route, particularly in the Basin and Range, Mojave Desert, and San Joaquin Valley Regions	36, 37, 38, 39 and 40	Realignment to avoid problem areas in the only way to effectively minimize impacts. Restricted access would enhance the probability of successful reclamation	No
	Loss of wildlife species of special concern could occur along portions of the entire route particularly affecting species in the Wyoming Basin, the Mojave Desert, and the San Joaquin Valley	41, 42a, 42b, 43, 44, 45, 46a, 46b, 47, 48a, 48b, 48c, 49a, 49b, 49c, 49d, 49e, 49g and 49h	Reduction of stress and impacts during critical time periods would minimize overall effects on the populations. Immediate revegetation replaces lost habitat with less impact on species. Field surveys define areas to avoid and/or regulate timing of activities.	No
LAND USE/OWNERSHIP Construction and operation	Land use/ownership conflicts	13, 57 and 66	Reduce land use/ownership conflicts	Yes
CULTURAL RESOURCES Construction and operation	Potential loss of significant cultural resources and the research potential which could be permanently destroyed	58 and 59	Gain as much non-redundant information and follow guidelines for research established in the technical report	No
PALEONTOLOGICAL RESOURCES Construction and operation	Potential loss of significant fossil finds and reduction of significant fossiliferous formations. Result in a permanent loss of the resource.	61	Reduce impacts by monitoring would allow some knowledge on the formation which would allow assessment of the formation for future research	No
VISUAL RESOURCES Construction and operation	Loss of pristine visual environment and degradation of established VRM class	62, 63a, 63b, 63c, 64 and 65	Reduce impacts to the visual environment to acceptable levels by following contours, revegetating, etc.	Yes

4.9 RELATIONSHIPS BETWEEN SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Short term is defined as the construction period of the Kern River Project plus one year for ROW rehabilitation. Long term is defined as the remaining life of the project through abandonment and reclamation. This would be approximately 40 years. Following the completion of project construction and rehabilitation of the ROW no significant decreases in productivity of the project area are expected.

Many of the significant impacts associated with the Kern River project would be short term and would cease to be significant following ROW rehabilitation. A summary of short-term and long-term impacts is presented in Table 4.9-1.

4.10 IRREVERSIBLE/IRRETRIEVABLE COMMITMENT OF RESOURCES

Construction and operation of the Kern River pipeline project and all alternatives could result in either the irreversible or irretrievable commitment of certain resources. An irreversible commitment of a resource is one which cannot be changed once it occurs; an irretrievable commitment means that the resource cannot be recovered or reused. Irreversible and irretrievable impacts are summarized in Table 4.10-1. No resources will be over committed by the construction or operation of the project.

4.11 GROWTH INDUCING IMPACTS

The growth inducing impacts discussed in Section 4.14 of Volume I would also occur if the Kern River Project were implemented. Another potential growth inducing impact would occur if the Kern River Pipeline Company would allow the communities in south-western Utah to connect lateral delivery lines in order to supply natural gas to the communities. If this were possible, the southwestern Utah region could attract new industry.

Table 4.9-1

SHORT-TERM AND LONG-TERM IMPACTS RESULTING FROM THE KERN RIVER PROPOSAL

Resource	Relationship of Short-Term Use of Environment and Long-Term Productivity
Air Quality	The project would not significantly deteriorate existing air quality in the project area on the long-term but would cause short-term impacts during the construction phases.
Geology	Impacts caused by slope stability problems would represent significant short-term impact; no long-term impacts are anticipated.
Soils	During construction there would be short-term losses of soil due to erosion; no long-term impacts are anticipated.
Surface Water	There would be short-term impacts to surface water during construction; no significant long-term impacts are anticipated.
Groundwater	No significant short-term or long-term impacts are anticipated.
Freshwater Biology	No significant short-term or long-term impacts are anticipated.
Vegetation	All vegetation types crossed by the pipeline would suffer short-term impacts. Oak woodlands, forestland and desert scrubland would not regenerate within the life of the project (40 years) and would suffer long-term impacts.
Wildlife	Losses to desert tortoises and other species of special concern as well as general wildlife species impacted would suffer short-term decreases in local populations. Long-term productivity would not be impaired.
Grazing	Destruction of forage would be a temporary impact that could change grazing patterns or alter management system for one to three grazing seasons.

Table 4.9-1 (continued)

SHORT-TERM AND LONG-TERM IMPACTS RESULTING FROM THE KERN RIVER PROPOSAL

Resource	Relationship of Short-Term Use of Environment and Long-Term Productivity
Socioeconomics	In the short-term, construction of the project would provide provide employment for 4,536 workers and result in increased spending in local areas. In the long-term, operations would employ 121 workers and increased property tax revenues would be realized by the counties crossed by the pipeline.
Traffic	There would be no short-term or long-term impacts to transportation.
Noise	Short-term impacts would occur to nearby residences during pipeline construction. There would be no significant long-term impacts.
Recreation	Short-term disruptions of recreation activities would occur. No significant long-term impacts would occur.
Land Use	Short-term disruptions of agriculture would occur. Long-term impacts to orchards and vineyards would occur.
Cultural Resources	Disturbance or destruction of cultural resources could result in the loss of some scientific understanding which would be both a short-term and long-term impact.
Paleontology	Disturbance or destruction of paleontological resources would result in the loss of some scientific understanding which would be both a short-term and long-term impact.
Visual Resources	Short-term impacts to visual resources would occur during construction of the pipeline and compressor station. Some impacts would remain for the life of the project.
System Safety	A major pipeline break could potentially occur during pipeline operation. Effects to sensitive resources could last from a few days to several years.

Table 4.10-1

COMMITMENT OF RESOURCES RESULTING FROM THE KERN RIVER PROPOSAL

Resource	Irreversible	Irretrievable	Comment
AIR QUALITY	no	no	No significant long-term commitment of resources
GEOLOGY	yes	yes	Slope stability problems along portions of the route would cause both irreversible and irretrievable commitment of resources.
SOILS	no	yes	Soil losses caused by both water and wind erosion would be irretrievable
SURFACE WATER	no	no	No significant long-term commitment of resources
GROUNDWATER	no	no	No significant long-term commitment of resources
FRESHWATER BIOLOGY	no	no	No significant long-term commitment of resources
VEGETATION	no	yes	The losses of oak woodlands, forestlands and desert scrubland would be irretrievable. Oak woodlands and desert scrubland would not regenerate within the life of the project (40 years). Riparian habitat might not recover to former state. These could be considered long-term commitments of resources.
WILDLIFE	no	yes	Losses to desert tortoise and other species of special concern as well as general wildlife species would be irretrievable. This could be considered long-term commitments of resources.
GRAZING	no	yes	Destruction of forage would change grazing patterns or alter management systems for one to three grazing seasons.

Table 4.10-1

COMMITMENT OF RESOURCES RESULTING FROM THE KERN RIVER PROPOSAL

Resource	Irreversible	Irretrievable	Comment
AIR QUALITY	no	no	No significant long-term commitment of resources
GEOLOGY	yes	yes	Slope stability problems along portions of the route would cause both irreversible and irretrievable commitment of resources.
SOILS	no	yes	Soil losses caused by both water and wind erosion would be irretrievable
SURFACE WATER	no	no	No significant long-term commitment of resources
GROUNDWATER	no	no	No significant long-term commitment of resources
FRESHWATER BIOLOGY	no	no	No significant long-term commitment of resources
VEGETATION	no	yes	The losses of oak woodlands, forestlands and desert scrubland would be irretrievable. Oak woodlands and desert scrubland would not regenerate within the life of the project (40 years). Riparian habitat might not recover to former state. These could be considered long-term commitments of resources.
WILDLIFE	no	yes	Losses to desert tortoise and other species of special concern as well as general wildlife species would be irretrievable. This could be considered long-term commitments of resources.
GRAZING	no	yes	Destruction of forage would change grazing patterns or alter management systems for one to three grazing seasons.

5.0 CEQA ALTERNATIVES

This section provides an analysis of the potential impacts associated with alternatives to the proposed project that were not addressed in Section 4. Although the alternatives discussed here may be feasible, limited design information is available on which to base the impact assessment. The analyses here therefore cannot be carried to the level of detail employed to evaluate the major alternatives discussed in Section 4. If one of the following alternatives is selected by decision makers, it is probable that a supplemental environmental analysis will be required after development of a specific project design.

5.1 ALTERNATIVE SOURCES OF NATURAL GAS

This section describes alternative methods for partial or complete use of locally available gas supplies.

Alternative gas supplies in both Santa Barbara and Kern Counties could be utilized if these supplies are not already used to full capacity. If southern California gas supplies were not being used to full capacity it may be possible for SoCal, PG&E and/or PGT to supply additional gas to the EOR market.

Based on discussions in Section 2 with regard to the intrastate systems, it is unlikely that this alternative would be feasible. If the gas supplies were not utilized to full capacity, California gas suppliers would be required to build natural gas pipelines and delivery laterals similar to those discussed in Section 2.

5.2 ALTERNATIVE METHODS FOR ENHANCED OIL RECOVERY

Alternative methods for enhanced oil recovery have been utilized by the oil industry in various portions of the country. Two methods of EOR could be potentially used which have not been previously discussed: water flooding of the formations and injection of carbon dioxide.

The water flooding method has been successfully used in oil fields throughout the country. While this method has been effective for some types of oil resources, the oil fields in the Kern County area would not be amenable to these methods since the viscosity of the oil would prevent movement of the oil to the well heads.

The carbon dioxide injection method has also been successfully employed in the New Mexico and west Texas oil fields, but again the viscosity of the oil in the Kern County fields would preclude the usage of CO2 injection.

5.3 ALTERNATIVE FUELS FOR ENHANCED OIL RECOVERY

Utilizing current technology no alternative fuels other than oil, natural gas or electricity would be feasible for generating steam for the EOR fields. At some point in the future, alternative fuel supplies such as solar power may be possible. The current state of solar technology, however, is not capable of generating sufficient supplies to meet even the current needs of the EOR market.

If at some point in the future solar powered generators were capable of producing steam in the quantities necessary, the net benefits in air quality and environmental impacts would be quite substantial. Since solar power would cause no air pollution, a great improvement in the air quality in the region would result. Construction of solar generating plants of the size necessary would cause substantially fewer impacts to the environment than those associated with construction of the interstate pipeline discussed in Section 4.

5.4 ALTERNATIVE PIPELINE ROUTES

A wide variety of alternative pipeline routes were described in Section 2. Short of constructing a totally new route no new alternative routings would be feasible.

5.5 ALTERNATIVE AIR POLLUTION CONTROLS

The steam generation plants currently operating in the Kern County area are burning crude oil to generate steam for injection into the oil fields. These plants are not currently using the best available control technology with regard to air pollution equipment. Converting the steam generation plants to the state-of-the-art air pollution control systems would be one way to lower pollution levels. While conversion to new air pollution control systems would be feasible, the costs would be prohibitive. Even installing new pollution control systems would not reduce pollution levels below the levels expected by converting the steam generator plants to natural gas power.

REFERENCES

REFERENCES

GENERAL

Bechtel, Inc. 1986
Preliminary Erosion Control and Revegetation Plan, Exhibit 4. San Francisco.

El Dorado Interstate Transmission Company 1985
Application for Certificate of Public Convenience and Necessity. Two vols. FERC Docket No. CP86-205. (second volume is Environmental Report, Exhibit Z, prepared by Bechtel, Inc.)

El Paso Natural Gas Company 1985
Application for a Certificate of Public Convenience and Necessity pursuant to Section 7(c) of the Natural Gas authorizing the firm transportation and delivery of natural gas and the construction and operation of certain facilities, with appurenances. Docket No. CP86-197-000. United States of America before the Federal Energy Regulatory Commission. (two copies).

El Paso Natural Gas Company 1986
Amendment to Application of El Paso Natural Gas Company for a Certificate of Public Convenience and Necessity. Docket No. CP86-197-001. United States of America before the Federal Energy Regulatory Commission.

Environmental Research and Technology, Inc. 1984
Draft Environmental Impact Report/Environmental Impact Statement for the Celeron/All American and Getty Pipeline Projects. Prepared for State Lands Commission and Bureau of Land Management. State Clearing House No. 83110902, Contract No. R 8353.

Environmental Research and Technology, Inc. 1985
Final Environmental Impact Report/Environmental Impact Statement for the Celeron/All American and Getty Pipeline Projects. Prepared for State Lands Commission and Bureau of Land Management. State Clearing House No. 83110902, Contract No. R 8353.

Kern River Gas Transmission Company 1985
Application for Certificate of Public Convenience and Necessity, Exhibit Z Environmental Report. Docket No. CP85- . two vols. (vol. 2 - Exhibit Z).

Kern River Gas Transmission Company 1985
Responses to California State Lands Commission Data Requests.

Kern River Gas Transmission Company 1985
Response of Kern River Gas Transmission to FERC Staff's Environmental Data Requests, Nos. 1-36 and 40. Docket No. CP85-552-000. (two copies).

Kern River Gas Transmission Company 1985
Response of Kern River Gas Transmission to FERC Staff's Environmental Data Requests, Nos. 37, 38, and 39. vol. 1, Responses; vol. 2, maps. Docket No. CP85-552-000.

Kern River Gas Transmission Company 1985
Geotechnical Study, Kern River Natural Gas Pipeline, Section with Potential Stability Problems (Wyoming and Utah) for Kern River Gas Transmission Company. Prepared by Golder Associates, Consulting Geotechnical and Mining Engineers, Denver, CO, for Kern River Gas Transmission Company. FERC Docket No. CP85-552. (three copies)

Kern River Gas Transmission Company 1986
Supplemental Responses of Kern River Gas Transmission Company to FERC Staff's Data Requests dated October 9, 1985, Nos. 10,14.b and 15. FERC Docket No. CP85-522-000.

Kern River Gas Transmission Company 1986
Kern River Pipeline Cultural Resource Overview. Prepared by Dames and Moore for Kern River Gas Transmission Company.

Northwest Pipeline Corporation 1983
Environmental Assessment of the Texas Eastern Loop Pipeline Project. Exihibit F-IV. FERC Docket No. CP82-176-000,001,0-02.

Mojave Pipeline Company 1985
Responses to Requests for Environmental Information. Docket No. CP85-437-000.

Mojave Pipeline Company 1985
Cultural Resources Technical Report for the Proposed Mojave Natural Gas Pipeline, California and Arizona. Prepared by Woodward-Clyde Consultants, Walnut Creek, Calif. Prepared for Mojave Pipeline Company, Houston, Texas.

Mojave Pipeline Company 1985
Application for Certificate of Public Convenience and Necessity. FERC Docket No. CP85-___. three vols. (vols. 2 and 3 are environmental reports)

Rocky Mountain Pipeline Company 1981
Draft Environmental Impact Statement for the Rocky Mountain Pipeline Project. FERC Docket No. CP79-424. BLM Case No. U-45957.

Rocky Mountain Pipeline Company 1981
Final Environmental Impact Statement for the Rocky Mountain Pipeline Project. FERC Docket No. CP79-424; BLM Case No. U-45957. two vols. (second is graphic supplement)

Rocky Mountain Pipeline Company 1981
Technical Report for Visual Resources: Rocky Mountain Pipeline Project EIS. BLM Office of Special Projects, Case No. U-45957. FERC Docket No. CP79-424.

State of Nevada
Handbook of Best Management Practices, Non-Designated Area Water Quality Management Plan. State of Nevada Conservation Commission and Department of Conservation and Natural Resources, Division of Environmental Protection.

Transwestern Pipeline Company 1985
Application for Certificate of Public Convenience and Necessity, Exhibit Z Environment Report. two vols. FERC Docket No. CP86-____. (2 copies).

Transwestern Pipeline Company
Abbreviated Application for a Certificate of Public Convenience and Necessity. FERC Docket No. CP86-212-000.

U.S. Dept. of Agriculture
Forest Service 1974
Kaibab National Forest Multiple Use Management Guide. Williams, Arizona.

U.S. Dept. of Agriculture
Forest Service 1984
Visual Resource Management Implementation Plan for the Uinta National Forest.

U.S. Dept. of Agriculture
Forest Service 1984
Final Environmental Impact Statement for the Forest Plan, Uinta National Forest. Provo, Utah.

U.S. Dept. of Agriculture
Forest Service 1984
Forest Plan. Land and Resource Management Plan for the Uinta National Forest. Provo, Utah.

U.S. Dept. of Agriculture
Forest Service 1984
Draft Environmental Impact Statement and Proposed Forest Land and Resources Management Plan for the Dixie National Forest. Cedar City, Utah.

U.S. Dept. of Agriculture
Forest Service 1985
Environmental Impact Statement for the Cibola National Forest Plan. Cibola National Forest, Albuquerque, New Mexico.

U.S. Dept. of Agriculture
Forest Service 1985
Summary of the Environmental Impact Statement for the Cibola National Forest Plan. Maps. Cibola National Forest, Albuquerque, New Mexico.

U.S. Dept. of Agriculture
Forest Service 1985
Cibola National Forest Land and Resource Management Plan. Albuquerque, New Mexico.

U.S. Dept. of Agriculture
Forest Service 1985
Public Comments and Forest Service Response to the DEIS, Proposed Cibola National Forest Plan. Albuquerque, New Mexico.

U.S. Dept. of Agriculture
Forest Service 1985
Draft Environmental Impact Statement, Proposed Coconino National Forest Plan. Maps. Flagstaff, Arizona.

U.S. Dept. of Agriculture
Forest Service 1985
Summary of the Draft Environmental Impact Statement for the Coconino National Forest Proposed Plan. Flagstaff, Arizona.

U.S. Dept. of Agriculture
Forest Service 1985
Proposed Coconino National Forest Plan. Flagstaff, Arizona.

U.S. Dept. of Agriculture
Forest Service 1985
Draft E.I.S. and Proposed Land and Resource Management Plan, Fishlake National Forest. Ogden, Utah.

U.S. Dept. of Agriculture
Forest Service 1985
Draft Environmental Impact Statement and Proposed Forest Land and Resource Management Plan for the Manti-LaSal National Forest. Price, Utah.

U.S. Dept. of Agriculture
Forest Service 1985
Wasatch-Cache National Forest Land and Resource Management Plan. Final Environmental Impact Statement. two vols. and maps. (Volume 1 - Chapters 1-5,7,Appendices; Volume 2-Chapter 6). Wasatch-Cache National Forest, Salt Lake City, Utah.

U.S. Dept. of Agriculture
Forest Service 1985
Wasatch-Cache National Forest Land and Resource Management Plan. Forest Plan and Appendices. Salt Lake City, Utah.

U.S. Dept. of Agriculture
Forest Service 1985
Record of Decision. Land and Resource Management Plan. Wasatch-Cache National Forest, Salt Lake City, Utah.

U.S. Dept. of Interior
Bureau of Land Management 1979
Draft and Final Environmental Impact Statement Intermountain Power Project. BLM, Utah State Office. four vols.(1st vol. is Salt Wash Proposal, 2nd vol. is Lynndyl Alternative Site, 3rd vol. is Project Alternatives, Appendices, and References, 4th vol. is Final EIS). (two copies)

U.S. Dept. of Interior
Bureau of Land Management 1980
The California Desert Conservation Area Plan. Desert District, Riverside, California.

U.S. Dept. of Interior
Bureau of Land Management 1982a
Draft Environmental Impact Statement, Uintah Basin Synfuels Development, Appendix R-A (Maps).

U.S. Dept. of Interior
Bureau of Land Management 1982b
Draft Environmental Assessment: Department of Energy Proposed Location and Baseline Studies in the Paradox Basin, Utah.

U.S. Dept. of Interior
Bureau of Land Management 1983
Draft Environmental Impact Statement on the Chevron Phosphate Project. State of Wyoming and Office of Industrial Siting Administration. Cheyenne, Wyoming.

U.S. Dept. of Interior
Bureau of Land Management 1983
Final Environmental Impact Statement on the Chevron Phosphate Project. State of Wyoming and Office of Industrial Siting Administration. Cheyenne, Wyoming.

U.S. Dept. of Interior
Bureau of Land Management 1983
Final Environmental Impact Statement, Uintah Basin Synfuels Development. two vols. Salt Lake City, Utah.

U.S. Dept. of Interior
Bureau of Land Management 1984
Aquatrain Corridor Study Report. Division of EIS Services for the Bureau of Reclamation, Saline Water Transport and Use Office. Interagency Agreement No. 3-AA-40-00590.

U.S. Dept. of Interior
Bureau of Land Management 1985
Draft Environmental Impact Report/Environmental Impact Statement for the Proposed Pacific Texas Pipeline Project. BLM, Riverside, California and Los Angeles, San Pedro, California. Cooperating agencies: U.S. Army Corps of Engineers, Los Angeles District (permit no. 85-97) and U.S.

U.S. Dept. of Interior
Bureau of Land Management 1985 (continued)
Dept. of the Interior, Fish and Wildlife Service, Region V. Interior DES 85-32. California State Clearing House No. 85013001.

U.S. Dept. of Interior
Bureau of Land Management 1985
Final Environmental Impact Report/Environmental Impact Statement for the Proposed Pacific Texas Pipeline Project. BLM, Riverside, California and Los Angeles, San Pedro, California. Cooperating agencies: U.S. Army Corps of Engineers, Los Angeles District (permit no. 85-97) and U.S. Dept. of the Interior, Fish and Wildlife Service, Region V. California State Clearing House No. 85013001.

AIR QUALITY

Bowers, Bjorklund and Cheney 1979
Industrial Source Complex Dispersion Model User's Guide. Prepared for the U.S. Environmental Protection Agency. EPA Publication EPS-450/4-79-030.

California Air Resources Board 1984
Letter from Rich Bradley, Emission Inventory Branch to Lawrence Hart, M.D., Air Pollution Control Officer, Santa Barabara County Air Pollution Control District regarding size-segragated particulate matter inventory for Santa Barbara County.

California Air Resources Board 1985
Kern County Ozone Modeling for SIP Revision. Prepared by CARB Technical Support Division.

Environmental Protection Agency 1985
Compilation of Air Pollutant Emission Factors, Fourth Edition, Publication AP-42, U.S. Environmental Protection Agency, Research Triangle Park, N.C.

National Oceanic and Atmospheric Administration 1978
Climates of the States, Volumes 1 and 2. Published by Gale Research Company, Detroit, Michigan.

Seigneur, C., T.W. Tesche, P.M. Roth, and M.K. Liu 1983
On the Treatment of Point Source Emissions in Urban Air Quality Modeling. Atmospheric Environment, Vol. 17, No. 9, pp. 1655-1676.

Turner, D. Bruce 1969
Workbook of Atmospheric Dispersion Estimates. U.S. Environmental Protection Agency, Publication AP-26.

Woodward-Clyde Consultants 1986
Letter from Charles R. Simpson, Woodward-Clyde Consultants to Paul Baye, Chambers Group, regarding project description of the Mojave and Transwestern Pipeline Projects.

GEOLOGY

Algermiessen, S.T., and D.M. Perkins 1976
A probabilistic estimate of maximum acceleration in rock in the contiguous United States: U. S. Geological Survey open-file report 76-416.

Algermiessen, S.T., D.M. Perkins, P. C. Thenhaus, S.L. Hanson, and B.L. Bender 1982
Probabilistic estimates of maximum acceleration and velocity in rock in the contiguous United States. U. S. Geological Survey open-file report 82-1033.

Anderson, Larry W. and Darryl G. Miller 1979
Quaternary fault map of Utah. Fugro, Inc., Consulting Engineers and Geologists. Long Beach, California. 1:500,000.

Anderson, L.R., J.R. Keaton, K. Aubry, and S.J. Ellis 1982
Liquefaction potential maps for Davis County, Utah. Utah State University Civil and Environmental Engineering Department and Dames and Moore Consulting Engineers.

Anderson, L.R., J.R. Keaton, T.F. Saarinen, and W.G. Wells, II 1984
Utah landslides, debris flows, and mud flows of May and June, 1983. Engineering Technical and Natural Resource Commission. National Acacdemy Press, Washington, D.C.

Arabasz, W.J., R.B. Smith, and W.D. Richins 1979
Earthquake studies in Utah 1850 to 1978, University of Utah Seismograph Station, Department of Geology and Geophysics, University of Utah, Salt Lake City, Utah.

Arizona Bureau of Mines 1958
Geologic map of Yavapai County, Arizona.

Arizona Bureau of Mines 1969
Mineral and water resources of Arizona, Bulletin 180.

Arnold, E.C. and J.M. Hill 1980
New Mexico's energy resources-1979. New Mexico Bureau of Mines and Mineral Resources, Circular 172.

Bara, J.P. 1977
Research on wetting collapsible foundation soils. Engineering and Research Center, Bureau of Reclamation, Denver, Colorado.

Basset, A.M. and D.H. Kupfer 1964
A geologic reconnaissance in the southeastern Mojave Desert, California. California Division of Mines and Geology. Special Report 83.

Beebey, D.J. and R.L. Hill 1975
Galway Lake Fault. In California Geology, October 1975, Volume 28, Number 10:219-221. California Division of Mines and Geology.

Bell, J.W. 1981
Subsidence in the Las Vegas Valley, Bulletin 95, Nevada Bureau of Mines and Geology.

Benjamin, J.R. and Associates 1980
Additional probability analyses of surface rupture offset beneath reactor building, General Electric test reactor. Jack R. Benjamin and Associates report to General Electric Company, Vallecitos Nuclear Center, Pleasanton, California.

Bishop, C.C. 1963
Geologic map of California, Needles sheet. California Division of Mines and Geology. 1:250,000.

Bradley, W.H. 1964
Geology of Green River formation and associated Eocene rocks in southwestern Wyoming and adjacent parts of Colorado and Utah. U.S. Geological Survey Professional Paper 496-A.

Burger, J.A. 1955
Geology of Central Uinta County, Wyoming. Master's Thesis, University of Utah, Salt Lake City, Utah.

Buwalda, J.P. and P. St. Amand 1955
Geological effects of the Arvin-Tehachapi earthquake. In Earthquakes in Kern County, California, during 1952. California Department of Natural Resources, Division of Mines, Bulletin 171, pp. 41-56.

California Division of Mines and Geology 1976a
Active fault mapping and evaluation program, Ten-year program to implement Alquist-Priolo special studies zones act. California Division of Mines and Geology, Special Publication 47.

California Division of Mines and Geology 1976b
Special studies zones official map, Monolith quadrangle. California Division of Mines and Geology. 1:24,000.

California Division of Mines and Geology 1976c
Special studies zones official map, Arvin quadrangle. California Division of Mines and Geology. 1:24,000.

California Division of Mines and Geology 1976d
Special studies zones official map, Coal Oil Canyon quadrangle. California Division of Mines and Geology. 1:24,000.

Case, James C. 1986
Preliminary map of landslides in Wyoming. U.S. Geological Survey Open-File Report 86-3. 1:1,013,760.

Cashion, William B. 1973
Geologic and structure map of the Grand Junction quadrangle, Colorado and Utah. U.S. Geological Survey miscellaneous geologic investigations map I-736. 1:250,000.

Cluff, Lloyd S. 1980
Wasatch Fault Zone, Utah proceedings of earthquake engineering research seminar, Salt Lake City, Utah.

Cluff, L.S., and D.P. Schwartz 1981
Recurrence of moderate to large magnitude earthquakes produced by surface faulting on the Wasatch Fault Zone, Utah. Preprint of a paper to appear in the Bulletin of the Seismological Society of America Vol. 70:5.

Colman, Steven M. 1985
Tectonic features of late Cenozoic origin in Colorado. U.S. Geological Survey miscellaneous investigations series map I-1566. 1:1,000,000.

Colton, Roger B., Jeffrey A. Holligan, Larry W. Anderson and Penny E. Patterson 1976
Preliminary map of landslide deposits in Colorado. U.S. Geological Survey miscellaneous investigations series map I-964. 1:500,000.

Dane, C.H. and G.O. Bachman 1965
Geologic map of New Mexico. U.S. Geological Survey. 1:500,000.

Dibblee, T.W. 1967
Aerial geology of the western Mojave Desert, California. U.S. Geological Survey professional paper 522.

Dibblee, T.W., Jr., and G.P. Louke 1970
Geologic map of the Tehachapi quadrangle, Kern County, California. U.S. Geological Survey miscellaneous investigations, map I-607. 1:62,500.

Dibblee, T.W., Jr., and A.H. Warne 1970
Geologic map of the Cummings Mountain quadrangle, Kern County, California. U.S. Geological Survey miscellaneous geologic investigations, map I-611. 1:62,500.

Doser, D.I. 1980
Earthquake recurrence rates from seismic moment rates in Utah. Master's thesis, University of Utah, Salt Lake City, Utah.

DuBois, S.M., A.W. Smith, N.K. Nye, and T.A. Nowak, Jr. 1982
Arizona earthquakes 1776-1980, Arizona Bureau of Geology and Mineral Technology, Bulletin 193.

Engineering Decision Analysis Company 1979
Probability analysis of surface rupture offset beneath reactor building, General Electric test reactor. Engineering Decision Analysis Company Report to General Electric Company, Vallecitos Nuclear Center, Pleasanton, California.

Gibbons, A.B. 1986
Surficial materials map of the Kemmerer 30' X 60' quadrangle, Lincoln, Uinta, and Sweetwater Counties, Wyoming. U.S. Geological Survey coal investigations map C-102. 1:100,000.

Gibbs, H.J. and J.P. Bara 1966
Stability problems of collapsible soil. Paper, ASCE conference on stability and performance of slopes and embankments, Berkeley, California. Bureau of Reclamation, Denver, Colorado. August.

Golder Associates 1985
Geotechnical study Kern River natural gas pipeline sections with potential stability problems (Wyoming and Utah).

Golder Associates 1986
Geotechnical study of the Kern River natural gas pipeline, Wasatch Variation.

Greensfelder, R.W. 1974
Maximum credible rock acceleration from earthquakes in California. California Division of Mines and Geology, Map Sheet 23. 1:250,000.

Hager, M.W. 1970
Fossils of Wyoming, Wyoming Geological Survey Bulletin 54, Laramie, Wyoming.

Hawkins, H.G. and J.L. McNey 1979
Homestead Valley earthquake swarm, San Bernardino County, California. In California Geology, Volume 32, Number 10:222-224. California Division of Mines and Geology.

Haynes, D.D., J.D. Vogel and D.G. Wyant 1972
Geology, structure, and uranium deposits of the Cortez quadrangle, Colorado and Utah. U.S. Geological Survey miscellaneous geologic investigations map I-629. 1:250,000.

Hill, R.L., J.C. Pechmann, J.A. Treiman, J.R. McMillan, J.W. Given, and J.E. Ebel 1980
Geologic study of the Homestead Valley earthquake swarm of March 15, 1979. In California Geology, Volume 33, Number 3:60-67. California Division of Mines and Geology.

Howard, K.A., and others 1978
Preliminary map of young faults in the United States as a guide to possible fault activity, map MF916, U.S. Geological Survey, Reston, Virginia.

International Conference of Building Officials 1983
Uniform Building Code. International Conference of Building Officials, Pasadena, California.

Jennings, C.W., J.L. Burnett, and B.W. Troxel 1962
Geologic map of California, Trona sheet. California Division of Mines and Geology. 1:250,000.

Jennings, C.W. 1975
Fault map of California with locations of volcanos, thermal springs, and thermal wells. California Division of Mines and Geology, Geologic data map No. 1. 1:500,000.

Kaliser, Bruce N. 1986
Chief, geologic hazards section, Utah Geologic and Mineral Survey, Personal communication with R. Gainer, EarthFax Engineering.

Keaton, J.R. and R.T. Keaton 1977
Manix fault zone, San Bernardino County, California. In California Geology, Volume 30, Number 8. California Division of Mines and Geology.

Kelley, V.C. 1972
Outcropping Permian shelf formations of eastern New Mexico. Guidebook, 23rd field conference, east-central New Mexico, New Mexico Geological Society.

Kittel, D.F., V.C. Kelley, and P.E. Melancon 1967
Uranium deposits of the Grants region. Guidebook, 18th field conference, New Mexico Geological Society.

Kottlowski, F.E. 1959
Pennsylvanian rocks of the northeast edge of the Datil Plateau. Guidebook, 10th field conference, New Mexico, New Mexico Geological Society.

Livingston & Associates and Moore & Taber 1979
Seismic safety and safety element, Santa Barbara County comprehensive plan. Santa Barbara County Board of Supervisors.

Lochman-Balk, C. 1967
Lexicon of stratigraphic names used in northwest New Mexico and adjacent States. Guidebook, 18th field conference, Defiance-Zuni-Mt. Taylor region, New Mexico Geological Society.

Lofgren, B.E. 1975
Land subsidence due to groundwater withdrawal, Arvin-Maricopa area, California. U. S. Geological Survey, Professional Paper 437-D.

Lofgren, B.E. 1985
Senior Consulting Hydrogeologist, Woodward-Clyde Consultants. Personal communication with T. Mullen, BIO\WEST, Inc.

Love, J.D. and Ann Coe Christiansen 1985
Geologic map of Wyoming. U.S. Geological Survey, in cooperation with the Geological Survey of Wyoming. 1:500,000.

Luedke, R.G. and R.L. Smith 1978
Map showing distribution, composition, and age of late Cenozoic volcanic centers in Arizona and New Mexico. U.S. Geological Survey Miscellaneous Investigation Series I-1091.

Menges, C.M. and P.A. Pearthree 1983
Map of neotectonic (latest Pliocene-Quaternary) deformation in Arizona. Arizona Bureau of Geology and Mineral Technology Open File Report 83-22.

National Oceanic and Atmospheric Administration (NOAA) 1977
Hypocenter data file, 1849. Environmental Data Service, Boulder, Colorado.

National Oceanic and Atmospheric Administration (NOAA) 1985
Summary of earthquake data base, National Environmental Satellite, Data, and Information Service. National Geophysical Data Center, Boulder, Colorado.

Nevada Bureau of Mines 1964
Mineral and water resources of Nevada. Bulletin 65. Mack K. School of Mines, University of Nevada. Reno, Nevada.

New Mexico Bureau of Mines and Mineral Resources 1965
Mineral and water resources of New Mexico. Bulletin 87.

Norris, R.M. and R.W. Webb 1976
Geology of California. John Wiley and Sons, Inc., New York.

Northrop, S.A. 1976
New Mexico's earthquake history 1849-1975. New Mexico Geological Society, Special Publication No. 6.

Oakeshott, G.B. 1976
Volcanos and earthquakes, geologic violence. McGraw-Hill Book Company, New York.

Olsen, K.H. 1979
The seismicity of north-central New Mexico with particular reference to the Cerrillos earthquake of May 28, 1918. In Guidebook, 30th field conference, New Mexico Geological Society.

Radbruch, D.H. and K.C. Crowther 1973
Map showing areas of estimated relative amounts of landslides in California. United States Geological Society Miscellaneous Geologic Investigations, Map I-747.

Reagor, B.G., C. W. Stover, and S.T. Algermiessen 1982
Seismicity map of the State of Texas. U.S. Geological Survey, Miscellaneous Field Studies Map MF-1388.

Reagor, B.G., C.W. Stover, and S.T. Algermiessen 1985
Seismicity map of the State of Wyoming. U.S. Geological Survey Miscellaneous Field Studies Map MF-1798. 1:1,000,000.

Real, C.R., T.R. Toppozada, and D.L. Parke 1978
Earthquake epicenter map of California, showing events from 1900 through 1974 equal to or greater than magnitude 4.0 or Intensity V. California Division of Mines and Geology, Map Sheet 39. 1:1,000,000.

Richter, C.F. 1955a
Foreshocks and aftershocks. In Earthquakes in Kern County, California during 1952. California Department of Natural Resources, Division of Mines Bulletin 171.

Richter, C.F. 1955b
Seismic history in the San Joaquin Valley. In Earthquakes in Kern County, California during 1952. California Department of Natural Resources, Division of Mines Bulletin 171.

Rogers, T.H. 1967
Geologic map of California, San Bernardino sheet. California Division of Mines and Geology. 1:250,000.

Rosepiler, M.J. and R. Reilinger 1977
Land subsidence due to water withdrawal in the vicinity of Pecos, Texas. Engineering Geology 11:295-304.

Rowley, P.D., W.R. Hansen, O. Tweto, and P.E. Carrara 1985
Geologic map of the Vernal 1° X 2° quadrangle, Colorado, Utah, and Wyoming. U.S. Geological Survey Miscellaneous Geologic Investigations map I-1526. 1:250,000.

Sanford, A.R., K.H. Olson, and L.K.Jaksha 1979
Seismicity of the Rio Grand Rift. In Rio Grande Rift: Tectonics and magmatism, R.E. Rieker, ed. American Geophysical Union, pp. 145-168.

Shimer, John A. 1972
Field guide to landforms in the United States, MacMillan Company, New York, New York.

Slemmons, D.B. 1977
State-of-the-art for assessing earthquake hazards in the United States. Report 6, Faults and earthquake magnitude, Miscellaneous Paper 5-73-1, U. S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi.

Smith, A.R. 1964
Geologic map of California, Bakersfield sheet. California Division of Mines and Geology. 1:250,000.

Smith, R.B. 1978
Seismicity, crustal structure, and intraplate tectonics of the interior of the western Cordillera. In Regional Geophysics of the Western Cordillera. Geologic Society of America.

Stewart, J.H. and J. E. Carlson 1978
Geologic map of Nevada, U.S. Geological Survey. Supercedes open-file report 74-68 & MF-930.

Stover, C.W., B.G. Reagor, and S.T. Algermiessen 1986
Seismicity map of the State of Utah. U.S. Geological Survey Miscellaneous Field Studies map MF-1856. 1:1,000,000.

Stover, C.W., B.G. Reagor, and S.T. Algermiessen 1984
Seismicity map of the State of Colorado. U.S. Geological Survey Miscellaneous Field Studies map MF-1694. 1:1,000,000.

Sullivan, R. 1980
A stratigraphic evaluation of the Eocene rocks of southwestern Wyoming. Report of Investigations 20, Geological Survey of Wyoming, Laramie, Wyoming.

Swan, F.H., III, D.P. Schwartz, and Lloyd S. Cluff 1978
Recurrence of moderate to large magnitude earthquakes produced by surface faulting on the Wasatch fault zone, Utah. In Special papers on Seismicity of the Wasatch Front and Great Basin-Sierra Nevada Boundary, Bulletin of the Seismological Society of America.

U. S. Department of Agriculture, Forest Service 1986a
Unpublished soil survey of the Manti-La Sal National Forest.

U. S. Department of Agriculture, Forest Service 1986b
Unpublished soil survey of the Uinta National Forest.

U. S. Department of Agriculture, Forest Service 1986c
Unpublished soil survey of the Wasatch National Forest.

U. S. Department of the Interior, Geological Survey 1965
Mineral and water resources of New Mexico.

U. S. Department of the Interior., Bureau of Land Management 1980.
The California desert conservation area plan.

Ulrich, G.E., L.D. Nealy, and R. Hereford 1984
Map showing geology, structure, and uranium deposits of the Flagstaff quadrangle, Arizona. United States Geological Society Miscellaneous Investigation Series I-1446.

University of Texas Bureau of Economic Geology 1976
Geologic atlas of Texas, Pecos sheet.

Utah Geological and Mineral Survey 1964
Mineral and water resources of Utah. Bulletin 73, Salt Lake City, Utah.

Ver Ploeg, A.J. and De Bruin, Rodney H. 1982
The search for oil and gas in the Idaho-Wyoming-Utah salient of the Overthrust Belt. Geological Survey of Wyoming, Report of Investigations 21, Laramie, Wyoming.

West, R.M. 1984
Paleontology and geology of the Bridger Formation, southern Green River Basin, southwestern Wyoming. Part 7. Survey of Bridger Artiodactyla, Milwaukee Public Museum no.6, Carnegie Museum of Natural History, Pittsburgh, Pennsylvania.

Whitney, John W. 1981
Surficial geologic map of the Grand Junction 1° X 2° quadrangle, Colorado and Utah. U.S. Geological Survey Miscellaneous Investigations Series Map I-1289. 1:250,000.

Williams, Paul L. 1964
Geology, structure, and uranium deposits of the Moab quadrangle, Colorado and Utah. U. S. Geological Survey Miscellaneous Geologic Investigations Map I-360. 1:250,000.

Wilson, E.D., R.J. Moore, and J.R. Cooper 1969
Geologic map of Arizona. U.S. Department of the Interior, Geological Survey.

Wilson, E.D. and R.J. Moore 1959
Geologic map of Mohave County, Arizona. Arizona Bureau of Mines.

Wilson, E.D., R.J. Moore, and J.R. Cooper 1969
Geologic map of Arizona. U.S. Department of the Interior, Geological Survey.

Witkind, Irving J. 1975
Preliminary map showing known and suspected active faults in Wyoming. U.S. Geological Survey open-file report 75-279. 1:500,000.

Wong, Ivan G. 1984
Seismicity of the Paradox Basin and the Colorado Plateau Interior. Technical report prepared for the Office of Nuclear Waste Isolation.

SOILS

Jorgensen, R. 1986
U.S. Forest Service, Soils of Kaibab National Forest, Arizona. Personal communication.

Maker, H. J., H. W. Dregne, V. G. Link, and J. U. Anderson. 1978
Soils of New Mexico. Agricultural Experiment Station, Research Report 285, New Mexico State University, Las Cruces, New Mexico.

Robertson, George. 1986
Unpublished Soil Survey of Coconino National Forest, Arizona. Personal communication.

U.S. Department of Agriculture, Forest Service. 1986a
Unpublished Soil Survey of Coconino National Forest.

U.S. Department of Agriculture, Forest Service. 1986b
Unpublished Soil Survey of Dixie National Forest, Utah.

U.S. Department of Agriculture, Forest Service. 1986c
Unpublished Soil Survey of Manti-La Sal National Forest.

U.S. Department of Agriculture, Forest Service. 1986d
Unpublished Soil Survey of Uinta National Forest, Utah.

U.S. Department of Agriculture, Forest Service. 1986e
Unpublished Soil Survey of Wasatch National Forest, Utah.

U.S. Department of Agriculture, Soil Conservation Service. 1944
Soil Survey of East Millard Area, Utah.

U.S. Department of Agriculture, Soil Conservation Service. 1967
General Soil map of Kern County, California.

U.S. Department of Agriculture, Soil Conservation Service. 1968
Soil Survey of Davis-Weber Area, Utah.

U.S. Department of Agriculture, Soil Conservation Service. 1969
General Soil map of Yavapai County, Arizona.

U.S. Department of Agriculture, Soil Conservation Service. 1970
Soil Survey of Torrance Area, New Mexico.

U.S. Department of Agriculture, Soil Conservation Service. 1971
Soil Survey of the Eddy Area, New Mexico.

U.S. Department of Agriculture, Soil Conservation Service. 1974
Soil Survey of Lea County, New Mexico.

U.S. Department of Agriculture, Soil Conservation Service. 1975a
Soil Survey of Apache County, Arizona, Central part.

U.S. Department of Agriculture, Soil Conservation Service. 1975b
Soil Survey of Valencia County, New mexico, Eastern part.

U.S. Department of Agriculture, Soil Conservation Service. 1975c
Soil Survey of Ward County, Texas.

U.S. Department of Agriculture, Soil Conservation Service. 1976a
Soil Survey of Beaver-Cove Fort Area, Utah.

U.S. Department of Agriculture, Soil Conservation Service. 1976b
Soil Survey of Heber Valley Area, Utah.

U.S. Department of Agriculture, Soil Conservation Service. 1976c
Soil Survey of Yavapai County, Arizona, Western part.

U.S. Department of Agriculture, Soil Conservation Service. 1977a
General Soil map of Clark County, Nevada, Northwest part.

U.S. Department of Agriculture, Soil Conservation Service. 1977b
General Soil map of Clark County, Nevada, South part.

U.S. Department of Agriculture, Soil Conservation Service. 1977c
Soil Survey of Washington County, Area, Utah.

U.S. Department of Agriculture, Soil Conservation Service. 1978a
Soil Survey of Mesa County Area, Colorado.

U.S. Department of Agriculture, Soil Conservation Service. 1978b General Soil map, parts of Summit and Wasatch Counties, Utah.

U.S. Department of Agriculture, Soil Conservation Service. 1980a Soil Survey of Morgan Area, Utah.

U.S. Department of Agriculture, Soil Conservation Service. 1980b Soil Survey of San Juan County, New Mexico, Eastern part.

U.S. Department of Agriculture, Soil Conservation Service. 1980c Soil Survey of Virgin River Area, Nevada-Arizona.

U.S. Department of Agriculture, Soil Conservation Service. 1981a Soil Survey of Kern County, California, Southeastern part.

U.S. Department of Agriculture, Soil Conservation Service. 1981b Soil Survey of Sanpete Valley Area, Utah.

U.S. Department of Agriculture, Soil Conservation Service. 1982a General Soil map of Mojave River Soil Survey Area, California.

U.S. Department of Agriculture, Soil Conservation Service. 1982b Soil Survey of Rio Blanco County Area of Colorado.

U.S. Department of Agriculture, Soil Conservation Service. 1983a Soil Survey of Coconino County Area, Arizona, Central part.

U.S. Department of Agriculture, Soil Conservation Service. 1983b Soil Survey of Lincoln County Area, New Mexico.

U.S. Department of Agriculture, Soil Conservation Service. 1984 Soil Survey of Fairfield-Nephi Area, Utah.

U.S. Department of Agriculture, Soil Conservation Service. 1985a Soil Survey of Las Vegas Valley Area, Nevada.

U.S. Department of Agriculture, Soil Conservation Service. 1985b General Soil map of Lincoln County, Wyoming, South part.

U.S. Department of Agriculture, Soil Conservation Service. 1985c General Soil map of Uinta County, Wyoming.

U.S. Department of Agriculture, Soil Conservation Service. 1986a Unpublished Soil Survey of Dolores and Montezuma Counties, Colorado.

U.S. Department of Agriculture, Soil Conservation Service. 1986b Unpublished Soil Survey of Garfield County, Colorado. (BEG)

U.S. Department of Agriculture, Soil Conservation Service. 1986c Unpublished Soil Survey of Grand County, Utah, Central part.

U.S. Department of Agriculture, Soil Conservation Service. 1986d Unpublished Soil Survey of parts of Grand and San Juan Counties, Utah, Canyonlands Area.

U.S. Department of Agriculture, Soil Conservation Service. 1986e Unpublished Soil Survey of Iron-Washington Area, Utah.

U.S. Department of Agriculture, Soil Conservation Service. 1986f Unpublished Soil Survey, Kern County, California, Northwestern part.

U.S. Department of Agriculture, Soil Conservation Service. 1986g Unpublished Soil Survey of Lincoln County, Nevada, South part.

U.S. Department of Agriculture, Soil Conservation Service. 1986h Unpublished Soil Survey of Sweetwater County, Wyoming.

U.S Department of the Interior, Bureau of Indian Affairs. 1972 Soil and Range Inventory of the Shiprock District Thirteen Area, Navajo Indian Reservation, New Mexico.

U.S Department of the Interior, Bureau of Land Management. 1979 Kingman-Arizona Order 3 Soil Study.

Wilson, L., M. Olsen, T. Hutchings, A. Southard, and A. Erickson. 1975.
Soils of Utah. Ag. Exp. St. Bull. #492, Utah State Univ. Logan, Utah.

GROUNDWATER

Baker, C.H. 1970
Water resources of the Heber-Kamas-Park City area, north-central Utah. Utah Department of Natural Resources Technical Publication 27.

Bedinger, M.S., W.H. Langer, and W.R. Moyle 1984a
Maps showing groundwater units and withdrawal, Basin and Range Province, southern California. U.S. Geological Survey Water Resources Investigations Report 83-4116-A.

Bedinger, M.S., T.W. Anderson, and W.L. Langer 1984b
Maps showing groundwater units and withdrawal, Basin and Range Province, Arizona. U.S. Geological Survey Water Resources Investigations Report 83-4114-A.

Bedinger, M.S., J.R. Harril, W.H. Langer, J.M. Thomas, and D.A. Mulvihill 1984c
Maps showing groundwater levels, springs, and depth to groundwater, Basin and Range Province, Nevada. U.S. Geological Survey Water Resources Investigations Report 83-4119-B.

Bjorklund, L.J. 1968
Groundwater resources of northern Juab Valley. Utah Department of Natural Resources Technical Publication 17.

Bjorklund, L.J. and G.B. Robinson, Jr. 1968
Groundwater resources of the Sevier River Basin between Yuba Dam and Leamington Canyon, Utah. U.S. Geological Survey Water Supply Paper 1848.

Brady, B.T., M.S. Bedinger, and D.L. Hart 1984a
Maps showing groundwater units and withdrawal, Basin and Range Province, New Mexico. Water Resources Investigations Report 83-4118-A. U.S. Geological Survey.

Brady, B.T., D.A. Mulvihill, D.L. Hart, and W.H. Langer 1984b
Map showing groundwater levels, springs, and depths to groundwater, Basin and Range Province, New Mexico. Water Resources Investigations Report 83-4118-B. U.S. Geological Survey.

Cordova, R.M., G.W. Sandberg, and W. McConkie 1972
Groundwater conditions in the central Virgin River basin, Utah. Utah Department of Natural Resources Technical Publication 40.

Davidson, E.S. 1979
Summary appraisals of the Nation's groundwater resources-Lower Colorado region. U.S. Geological Survey Professional Paper 813-R.

Dinwiddie, G.A., and W.S. Motts 1964
Availability of groundwater in parts of the Acoma and Laguna Indian Reservations, New Mexico. U.S. Geological Survey Water Supply Paper 1576e.

Eakin, T.E., D. Price, and J.R. Harrill. 1976
Summary appraisals of the Nation's groundwater resources-Great Basin region. U.S. Geological Survey Professional Paper 813-G.

Feltis, R.D. 1966
Water from bedrock in the Colorado Plateau of Utah. Utah State Engineer Technical Publication 15.

Garza, S. and J.B. Wesselman 1962
Geology and groundwater resources of Winkler County, Texas. U.S. Geological Survey Water Supply Paper 1582.

Gates, J.S., J.I. Steiger, and R.T. Green. 1984
Groundwater reconnaissance of the central Weber River area, Morgan and Summit Counties, Utah. Utah Department of Natural Resources Technical Publication 77.

Heath, Ralph C. 1984
Groundwater regions of the United States. U.S. Geological Survey Water Supply Paper 2242.

Iorns, W.V., C.H. Hembree, D.A. Phoenix and G.L. Oakland. 1964
Water resources of the upper Colorado River basin - basic data. U.S. Geological Survey Professional Paper 442.

Iorns, W.V., C.H. Hembree and G.L. Oakland. 1964
Water resources of the upper Colorado River basin. U.S. Geological Survey Professional Paper 441.

Kelley, T.E. 1974
Reconnaissance investigations of groundwater in the Rio Grande Drainage Basin with special emphasis on saline groundwater resources. Hydrologic Investigations Atlas HA-510. U.S. Geological Survey.

Langer, W.H., W.R. Moyle, L.R. Woolffenden, and D.A. Mulvihill. 1984a
Maps showing groundwater levels, springs, and depth to groundwater, Basin and Range Province, southern California. U.S. Geological Survey Water Resources Investigations Report 83-4116-B.

Langer, W.L., D.A. Mulvihill, and T.W. Anderson. 1984b
Maps showing groundwater levels, springs, and depth to groundwater, Basin and Range Province, Arizona. U.S. Geological Survey Water Resources Investigations Report 83-4114-B.

Mower, R.W. 1965
Groundwater resources of Pavant Valley, Utah. U.S. Geological Survey Water Supply Paper 1794.

Mower, R.W. 1982
Hydrology of the Beryl-Enterprise Area, Escalante Desert, Utah, with emphasis on groundwater. Utah Department of Natural Resources Technical Publication 73.

Price, D. and T. Arnow. 1974
Summary appraisals of the Nation's groundwater resources-upper Colorado region. U.S. Geological Survey Professional Paper 813-C.

Richey, S.F., J.G. Wells, and K.T. Stephens 1985
Geohydrology of the Delaware Basin and vicinity, Texas/New Mexico. Water Resources Investigations Report 84-4077. U.S. Geological Survey.

Stone, W.J., F.P. Lyford, P.F. Frenzel, N.H. Mizell, and E.T. Padgett 1983
Hydrogeology and water resources of San Juan Basin, New Mexico. New Mexico Bureau of Mines and Mineral Resources Hydrologic Report 6.

Thompson, T.H., R.C. Shappell, and D.L. Hart 1984a
Map showing distribution of dissolved solids and dominant chemical type in groundwater, Basin and Range Province, New Mexico. U.S. Geological Survey.

Thompson, T.H., J. Nutter, and T.W. Anderson 1984b
Maps showing distribution of dissolved solids and dominant chemical type in groundwater, Basin and Range Province, Arizona. U.S. Geological Survey Water Resources Investigations Report 83-4114-C.

U.S. Geological Survey. 1985
National water summary 1984- Hydrologic events, selected water quality trends, and groundwater resources. U.S. Geological Survey water supply paper 2275.

Welder, George F. 1968
Ground-water reconnaissance of the Green River basin, southwestern Wyoming. U.S. Geological Survey Hydrologic Investigations Atlas HA-290, prepared in cooperation with Wyoming State Engineer. 1:250,000.

West, S.W., and W.L. Broadhurst 1975
Summary appraisals of the nation's groundwater resources - Rio Grande Region. U.S. Geological Survey Professional Paper 813D.

Whitfield, M.S., William Thordarson, W.J. Oatfield, E.A. Zimmerman and B.F. Rueger. 1983
Regional hydrology of the Blanding-Durango area, southern Paradox basin, Utah and Colorado. U.S. Geological Survey Water Resources Investigations Report 83-4218.

FRESHWATER BIOLOGY

Baxter, G.T. and J.R. Simon 1970
Wyoming fishes. Bulletin 4, Wyoming Game and Fish Dept,. Cheyenne.

Brown, T. 1978
Fishes, amphibians and reptiles of the Mojave River system. Bureau of Land Management, Riverside, CA. Contract No. CA-060-CT8-000046.

Button, C. 1986
Bureau of Land Management, San Juan Resource Area, Durango, Colorado. Personal communication with L. Crist, BIO/WEST, Inc.

Christansen, D. 1986
District Biologist, California Fish and Game, Kern River Planning Office. Personal communication with L. Crist, BIO/WEST, Inc.

Dalton, L. 1986
Resource Analyst, Utah Division of Wildlife Resources, Southeast Region, Price, Utah. Personal communication with L. Christ, BIO/WEST, Inc.

Diswood, S. 1986
Director, Navajo Fish and Game Navajo Nation. Personal communication with L. Crist, BIO/WEST, Inc.

Hollowed, E. 1986
Bureau of Land Management, White River Resource Area, Meeker, Colorado. Personal communication with L. Crist., BIO/WEST,Inc.

Holden, P., R. Hugie, L. Crist, S. Chanson and W. Masslich 1986
Development of a fish and wildlife classification system for backwaters along the lower Colorado River. Prepared for Bureau of Reclamation, lower Colorado region, contract no. 3-CS-30-01020.

Lambeth, Ron 1986
Bureau of Land Management, Grand River Resource Area. Personal Communication with L. Crist, BIO/WEST, Inc.

Marshall, C.W. 1976
Inventory of fish species and the aquatic environment of fifteen backwaters of the Topock Gorge Division of the Colorado River. Administrative Report 76-4, Dept. of Fish and Game, Chino, CA.

Minckley, W.L. 1979
Aquatic habitats and fishes of the lower Colorado River, southwestern United States. Final report for the Bureau of Reclamation, Boulder City, NV.

New Mexico Department of Natural Resources 1985
List of rare, threatened, and endangered species.

Murphy, M.L., C.P. Hawkins, and N.H. Anderson 1981
Effects of Canopy Modification and Accumulated Sediments on Stream Communities. Trans. American Fisheries Society 110:469-478.

Reed, S.R. 1977
Stream Community Response to Road Construction. Virginia Water Resources Research Center Bulletin 97.

Richards, Carl and P.B. Holden 1981
Fisheries distribution and species composition inventory, Rock Springs District/Salt Wells Resource Area, Wyoming. Prepared for the Department of Interior, Bureau of Land Management, Contract No. YA-512-CT9-266.

Scoppetomme, G. 1986
U.S. Fish and Wildlife Service, Reno, NV. Personal communication with L. Crist, BIO/WEST, Inc.

Stephenson, R.L. 1984
Arizona coldwater fisheries strategic plan 1985-1990. Public review draft. Federal Aid project FW-11-R. Arizona Fish and Game Dept.

U.S. Department of Interior, Bureau of Land Management 1980
The California desert conservation plan.

U.S. Fish and Wildlife Service 1980
Special report on distribution and abundance of fishes of the lower Colorado River. USFWS Ecological Services, Phoenix, Arizona.

U.S. Fish and Wildlife Service 1984
Endangered species of Arizona and New Mexico, 1984. Office of Endangered Species, Albuquerque, New Mexico.

VEGETATION

Agricultural Experiment Station and Cooperative Extension Service, University of Arizona. 1965
Arizona natural vegetation. Bulletin A-45 (map).

Barbour, M.G. and J. Major (eds.). 1977
The terrestrial vegetation of California. Wiley Interscience.

Callison, J., J.D. Brotherson and J.E. Bowns. 1985
The effects of fire on the Blackbrush (Coleogyne Ramosissima) community of southwestern Utah. Journal of Range Management. 38:535-538.

Cheatham, N.H. and J. Robert Haller. 1975
An annoted list of California habitat types. Natural Land and Water Reserves system, University of California, Santa Barbara.

Cronquist, Arthur, A.H. Holmgren, N.H. Holmgren, and J.L. Reveal. 1972. Intermountain flora: Vascular plants of the Intermountain West, U.S.A. Hafner Publishing Co., New York, New York.

Dickens, G.C. 1986
Regional Habitat Specialist, Arizona Fish and Game Department. Personal communication with Bill Masslich, BIO/WEST, Inc.

Donart, G.B., D.D. Sylvester and W.C. Hickey. 1978
Potential natural vegetation: New Mexico. U.S. Department of Agriculture Soil Conservation Service, New Mexico Interagency Range Committee, report 11.

Environmental Research and Technology, Inc. 1983
Riley Ridge Natural Gas Project, soils/vegetation/reclamation technical report.

Foster, R.H. 1985
Distribution of major plant communities in Utah. Utah Division of State Lands and Forestry, Salt Lake City.

Lathrop, E.W. and E.F. Archbold. 1983
Plant responses of utility corridors in the Mojave Desert. In Crossosoma: Southern California Botanists, Vol. 9, 7:9-16.

MacMahon, J. 1985
Deserts. Alfred A. Knopf, Inc., New York, New York.

Twisselmann, E.C. 1967
A flora of Kern County, California. Wassmann Journal of Biology 25:1-395.

U.S. Department of Interior, Bureau of Land Management 1984
Draft Environmental Impact Report/Environmental Impact Statement for the Celeron/All American and Getty Pipeline Projects. State Clearing House no. 83110902, contract no. R 8353.

U.S. Department of Interior, Bureau of Land Management (BLM). 1980. Draft California Desert Conservation Area Plan.

Vasek, F.C., H.B. Johnson and D.H. Eslinger. 1975
Effects of pipeline construction on creosote bush vegetation of the Mojave Desert. Madrono 23:1-64.

WILDLIFE

Archer, D. 1986
Endangered Species Team, U.S. Fish and Wildlife Service, Salt Lake City, Utah. Personal communication with B. Chanson, BIO/WEST, Inc.

Arizona Fish and Game Department 1986
Nongame Data Management System. Phoenix, Arizona.

Armstrong, D. 1972
Distribution of mammals in Colorado. Monograph No. 3. Museum of Natural History, University of Kansas, Lawrence, Kansas.

Baggao, D. 1986
Bureau of Land Management, Roswell Resource Area, Roswell, New Mexico. Personal communication with Bill Masslich.

Baker, B. 1986
Bureau of Land Management, Kemmerer Resource Area, Kemmerer, Wyoming. Personal communication with B. Chanson, BIO/WEST, Inc.

Berry K. (ed.) 1984
The status of the desert tortoise (Gopherus agassizi) in the United States. ed. Report from Desert Tortoise Council to U.S. Fish and Wildlife Service, Sacramento, CA. Order No. 11310-0083-81.

Blum, L. 1986
U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Condor Research Center, Ventura, California. Personal communication with Roy Hugie, BIO/WEST, Inc.

Button, C. 1986
Bureau of Land Management, San Juan Resource Area, Durango, Colorado. Personal communication with B. Chanson, BIO/WEST, Inc.

Cockrum, E.L. 1960
The recent mammals of Arizona: Their taxonomy and distribution. The University of Arizona Press. Tucson Arizona.

Dalton, L. 1986
Resource Analyst, Utah Division of Wildlife Resources, Southeast Region, Price, Utah. Personal communication with B. Chanson.

Dickens, G.C. 1986
Regional Habitat Specialist, Arizona Fish and Game Department, Flagstaff, Arizona. Personal communication with Bill Masslich, BIO/WEST, Inc.

Edelman, W. 1986
Research Associate, University of Wyoming, Laramie, Wyoming. Personal communication with R. Hugie, BIO/WEST, Inc.

Ferrell, S. 1986
Habitat Specialist, Arizona Fish and Game Department, Kingman, Arizona. Personal communication with Bill Masslich, BIO/WEST, Inc.

Findley, J.S., A. H. Harris, D.E. Wilson and C. Jones 1975. Mammals of New Mexico. University of New Mexico Press, Albuquerque, New Mexico.

Goodwin, G. 1986
U.S. Forest Service, Coconino National Forest, Flagstaff, Arizona. Personal communication with B. Chanson, BIO/WEST, Inc.

Gonzales, J. 1986
New Mexico Fish and Game Department. Big Game Management section. Personal communication with B. Masslich, BIO/WEST, Inc.

Hall, R. 1986
Biologist, Bureau of Land Management, Kingman Resource Area, Kingman, Arizona. Personal communication with W. Masslich, BIO/WEST, Inc.

Hammond, F. 1986
Wyoming Game and Fish Department, Lander, Wyoming. Personal communication with B. Chanson, BIO/WEST, Inc.

Hollowed, E. 1986
Bureau of Land Management, White River Resource Area, Meeker, Colorado. Personal communication with B. Chanson, BIO/WEST, Inc.

Hubbard J.P. and C.G. Schmitt 1984
The black-footed ferret in New Mexico. New Mexico Department of Game and Fish final report to Bureau of Land Management. Santa Fe, New Mexico. Contract No. NM-910-CT1-7.

Juen, Jesse. 1986
Wildlife Biologist, Bureau of Land Management, Carlsbad Resource Area. Personal communication with Bill Masslich, BIO/WEST, Inc.

Lambeth, Ron. 1986
Bureau of Land Management, Grand River Resource Area. Personal communication with B. Chanson, BIO/WEST, Inc.

Linder, R. 1970
Interrelations of prairie dogs and ferrets. Trans. 15th Annual Summer Conference Central Mountains and Plains Section Wildlife Society. Pinegree Park, Colorado.

Louis, W. 1986
Range Conservationist BIA, Laguna Agency. Personal communication with B. Masslich, BIO/WEST, Inc.

MacMahon,J. 1985
Deserts. Alfred A. Knopf,Inc. New York, New York.

Moretti, M. 1986
Utah Division of Wildlife Resources, Southeast Region, Price, Utah. Personal communication with B. Chanson, BIO/WEST, Inc.

Nelson, K. 1986
Utah Division of Wildlife Resources, Central region, Springville, Utah. Personal communication with B. Chanson, BIO/WEST, Inc.

New Mexico Department of Game and Fish. 1985
Handbook of species endangered in New Mexico. Santa Fe, New Mexico.

New Mexico Department of Natural Resources. 1985
List of rare threatened and endangered species.

Perschon, C. 1986
Utah Division of Wildlife Resources, Northeastern Region, Vernal, Utah. Personal communication with B. Chanson, BIO/WEST, Inc.

Reyes-French, G. 1985
Desert tortoise mitigation plan for the All American Pipeline Project. Bureau of Land Management, Riverside, California.

Ritter, S. 1986
Wyoming Game and Fish Department, Lander, Wyoming. Personal communication with B. Chanson, BIO/WEST, Inc.

Schwable, C. 1986
Non-game Biologist, Arizona Game and Fish Department, State Office, Phoenix, Arizona. Personal communication with R. Hugie, BIO/WEST, Inc.

Small, A. 1974
The Birds of California. Winchester Press, New York, New York.

State of California Resource Agency, Fish and Game Commission and Department of Fish and Game. 1980
At the crossroads. A report on the status of California's endangered and rare fish and wildlife. California Department of Fish and Game, Sacramento, California.

Stebbins, R. 1985
A field guide to western reptiles and amphibians, Revised edition. Houghton Mifflin Co. Boston, Mass.

Tsukamoto, G. 1975
A brief history and status of bighorn sheep in Nevada. In J.B. Trefethen, ed. The wild sheep in modern North America. Proceedings of the workshop on the management biology of North American wild sheep. Winchester Press, New York, New York.

Turner, R. 1986
Nevada Department of Wildlife, Region 111, Las Vegas, Nevada. Personal communication with B. Chanson, BIO/WEST Inc.

U.S. Department of Agriculture, Forest Service. 1985
Draft Environmental Impact Statement, Proposed Coconino National Forest Plan, Flagstaff, Arizona.

U.S. Department of Agriculture, Forest Service. 1985
Final Wasatch-Cache National Forest Land and Resource Management Plan. Wasatch-Cache National Forest, Salt Lake City, Utah.

U.S. Department of Agriculture, Forest Service. 1986
Draft Environmental Impact Statement, Proposed Kaibab National Forest Plan, Williams, Arizona.

U.S. Department of Interior. 1980
Federal Reg. 45 (163):55654-55666. Government Printing Office, Washington, D.C.

U.S. Department of Interior, Bureau of Land Management. 1978
Final Enviromental Impact Statement for proposed development of coal resources in southwestern Wyoming. Regional Analysis, Volume I. Washington, D.C.

U.S. Department of Interior, Bureau of Land Management. 1979
Draft Intermountain Power Project Environmental Impact Statement. Volume 1, Salt Wash proposal. Salt Lake, Utah.

U.S. Department of Interior, Bureau of Land Management. 1980.
Draft California Desert Conservation Area Plan.

U.S. Department of Interior, Bureau of Land Management. 1982
Draft Clark County Grazing Environmental Impact Statement. Las Vegas District, Las Vegas, Nevada.

U.S. Department of Interior, Bureau of Land Management. 1984a
Draft Celeron/All American and Getty Pipeline Projects Environmental Impact Statement. California Desert District, Riverside, California.

U.S. Department of Interior, Bureau of Land Management. 1984b
Threatened and Endangered Species Biological Assessment for the Celeron/All American and Getty Pipeline Projects. California Desert District, Riverside, California.

U.S. Department of Interior, Bureau of Land Management. 1985a Draft Kemmerer Resource Management Plan and Enviromental Impact Statement. Rock Springs District Office, Rock Springs, Wyoming.

U.S. Department of Interior, Bureau of Land Management. 1985b Draft Mead/McCullough-Victorville/Adelanto Transmission Project Environmental Report. California Desert District, Riverside, California.

U.S. Department of Interior, Bureau of Land Management. 1986 Phoenix District Bureau of Land Management Data File. Phoenix, Arizona.

U.S. Department of Interior, Bureau of Land Management. Unpublished data a. In-house data files of the Beaver Resource Area, Cedar City, Utah.

U.S. Department of Interior, Bureau of Land Management. Unpublished data b. In-house data files of the Dixie Resource Area. St. George, Utah.

U.S. Department of Interior, Bureau of Land Management. Unpublished data c. In-house data files of the Grand Resource Area, Moab, Utah.

U.S. Department of Interior, Bureau of Land Management. Unpublished data d. In-house data files of the Grand Junction District, Grand Junction, Colorado.

U.S. Department of Interior, Bureau of Land Management. Unpublished data e. In-house data files of the Green River Resource Area, Green River, Wyoming.

U.S. Department of Interior, Bureau of Land Management. Unpublished data f. In-house data files of the Kemmerer Resource Area, Kemmerer, Wyoming.

U.S. Department of Interior, Bureau of Land Management. Unpublished data g. In-house data files of the Stateline Resource Area, Las Vegas, Nevada.

U.S. Department of Interior, Bureau of Land Management. Unpublished data h. In-house data files of the Warm Springs and House Range Resource Areas, Fillmore, Utah.

U.S. Department of Interior, Bureau of Land Management. Unpublished data i. In-house data files of the White River Resource Area, Meeker, Colorado.

U.S. Fish and Wildlife Service. 1984 Endangered species of Arizona and New Mexico, 1984. Office of Endangered Species, Albuquerque, New Mexico.

U.S. Fish and Wildlife Service. 1985
Blunt-nosed leopard lizard recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service. 1986
Black-footed ferret survey guidelines for compliance with the Endangered Species Act. U.S. Fish and Wildlife Service, Denver, Colorado and Albuquerque, New Mexico.

Utah Division of Wildlife Resources. Unpublished data a.
In-house data files of the Southeastern Region, Price, Utah.

Utah Division of Wildlife Resources. Unpublished data b.
In-house data and map overlay system. Utah Division of Wildlife Resources, Southern Division, Cedar City, Utah.

Utah Division of Wildlife Resources. Unpublished data c.
Vertebrate wildlife of Central Utah and narrative and key for the Central Region of the Division of Wildlife Resources map overlay system to rank critical, high priority, substantial and limited value wildlife use area. Utah Division of Wildlife Resources, Central Region, Springville, Utah.

Utah Division of Wildlife Resources. Unpublished data d.
Vertebrate wildlife species of Northern Utah and narrative and key for the Division of Wildlife Resources map overlay system to rank critical, high priority, substantial and limited value wildlife use area. Utah Division of Wildlife Resources, Northern Region, Ogden, Utah.

Vasek, F.C., H.B. Johnson and D.H. Eslinger. 1975
Effects of pipeline construction on creosote bush vegetation of the Mojave Desert. Madrono 23:1-64.

Williams, D.F. 1980
Distribution and population status of the San Joaquin antelope squirrel and giant kangaroo rat. California Department of Fish and Game, Nongame Wildlife Final Report, E-W-4, IV10.1.

Williams, D.F. 1985
A review of the population status of the Tipton kangaroo rat, Dipodomys nitratoides nitratoides. Final report, USDI, Fish and Wildlife Service.

Wyoming Game and Fish. Unpublished data
In-house data files, Green River, Wyoming.

Zarn, M. 1974. The spotted owl, strix occidentalis. Habitat Management series for unique or endangered species. Report No. 10. Bureau of Land Management, Denver Service Center, Denver, Colorado.

GRAZING

Murphey, T. 1986
Personal communication. Range Conservationist, Green River Resource Area, Rock Springs, Wyoming.

Smith, B.C. 1986
Personal communication. Resource Area Manager, White River Resource Area. Meeker, Colorado.

U.S. Department of Interior, Bureau of Land Management 1983
Draft Grand Resource Area Management Plan and EIS. Moab District Office, Moab, Utah.

U.S. Department of Interior, Bureau of Land Management 1985a
Draft Kemmerer Resource Management Plan and Environmental Impact Statement. Rock Springs District Office, Rock Springs, Wyoming.

U.S. Department of Interior, Bureau of Land Management 1986
Unpublished data. Grand Junction Resource Area, Grand Junction, Colorado.

SOCIOECONOMICS

American Hospital Association 1985
Guide to Health Care Field. Chicago.

American Hotel Association Directory Corp. 1985
Hotel and Motel Redbook, 1985-1986. 99th Annual Edition, Pac-Tel Publishing.

Arizona Department of Transportation 1985
Traffic on the Arizona Highway System, 1984. Arizona Highway System Report # 3230-85-2, Transportation Planning Division, Planning Support Section, Travel and Facilities Branch.

Bill Communications 1985
Sales and Marketing Management, July 22, 1985, New York (periodical).

Bureau of Business and Economic Research 1984
New Mexico Statistical Abstract. University of New Mexico, Albuquerque, NM.

Bureau of Business and Economic Research 1985
Utah! Facts. 1985-1986 Edition. Graduate School of Business, University of Utah.

California Department of Transportation 1985
Traffic Volumes on California State Highways. Business, Transportation and Housing Agency, Division of Traffic Engineering.

Federal Bureau of Investigation 1984
Uniform Crime Reports for the United States. Dept. of Interior, Wasington, D.C.

Gulf Interstat Engineering 1985
Mojave Pipeline Company: preliminary engineering and capital cost estimate.

Hobbs Chamber of Commerce and City of Hobbs 1986
Community Facts and Facilities, a survey of Hobbs, Lea County, NM.

Nevada Department of Transportation 1985
Annual Traffic Report. Planning and Program Development, Traffic Section.

New Mexico Health Systems Agency 1984
District Data Profiles. Albuquerque, NM.

Parnell, Kerr, and Forster 1985
Trends in the Hotel Industry, Central California. Washington, D.C.

State of New Mexico 1985
New Mexico Local Governments and the Property Tax, 1985. Dept. of Finance and Administration, Local Government Division.

State of New Mexico 1985
Reported Gross Receipts: Annual Summary, December 1985. Taxation and Revenue Dept., Combined Revenue System, Report No. 080, January 1986.

Transwestern Pipeline Company 1986
Equipment use, construction methods and employment data, submitted to Chambers Group, Inc. Albuquerque, New Mexico.

T.L. Enterprises, Inc. 1985
Trailer Life, 1985 RV Campground and Service Directory. Agoura, CA.

Towler, W.L. and Winkel, M.J. 1986
City of Kingman Community Perspective, 1985-1986. Southwest Planning and Research and Spectrum Associates, Flagstaff, AZ.

University of Utah 1985
Labor Market Area Profiles Reports prepared for the Business and Economic Development Division, Department of Community and Economic Development, State of Utah.

U.S. Dept. of Commerce 1980
Census of Housing. Bureau of Census.

U.S. Dept. of Commerce 1983
County and City Data Book, 10th edition. Bureau of Census.

U.S. Dept. of Commerce 1983, 1984
County Business Patterns.

U.S. Dept. of Commerce 1985
Current Population Reports, Local Population Estimates.

U.S. Dept. of Commerce 1985
Local Area Personal Income, Volumes 7,8,9 in June.

U.S. Dept of Labor 1984
Local Area Unemployment Statistics.

Utah Dept. of Transportation 1986
Traffic on Utah Highways, 1985. Transportation Planning Division, Travel Analysis Unit.

Wyoming State Highway Department 1985
Wyoming Vehicle Miles. Planning Branch.

Refer to the Personal Communications Table for further socioeconomic references.

LAND USE

Apache, County of 1983
Comprehensive Plan. Planning and Zoning Commission and Board of Supervisors. Apache County, Arizona.

Arizona, State of 1976
Official Compilation of Administrative Rules and Regulations. Department of State, Phoenix, Arizona.

Bakersfield, City of 1984
Bakersfield City Data Book, Selected 1980 U.S. Census Tabulations. Fire and Development Services Department, Planning Division. Bakersfield, California.

Bakersfield, City of 1985
Bakersfield Municipal Code, Reprint of Title 17 Zoning. Bakersfield, California.

Boulder City, City of n.d.
Physical Resource Conservation Plan, Chapter 11. Planning Commission. Boulder City, Nevada.

Clark, County of 1985
Comprehensive Plan. Task One, existing conditions. Task Two, growth forecast and impact analysis. Task Six, goals, objectives, policies, programs and actions. Board of Commissioners, County Manager, and Planning Commission. Clark County, Nevada.

Clark, County of 1985
Population Data. Department of Comprehensive Planning. Las Vegas, Nevada.

Clark, County of n.d.
Clark County Wetlands Park, Master Plan and Phase 1 Development. Department of Comprehensive Planning and Parks and Recreation. Clark County, Nevada.

Coconino, County of n.d.
General Plan, 1990. Planning and Zoning Commission. Coconino County, Arizona.

Coconino, County of n.d.
Bellemont Study Area. Board of Supervisors and Planning and Zoning Commission. Coconinio County, Arizona.

Flagstaff, City of 1986
Growth Management Guide 2000, a physical development guide for Flagstaff. Planning Division, Flagstaff, Arizona.

Grand, County of 1985
Comprehensive Development Plan of Grand County, Utah Including Moab and Spanish Valley. Grand County and Moab City Commission and Planning Commission. Grand County, Utah.

Grants, City of 1982
Comprehensive Zoning Ordinance for the City of Grants. Middle Rio Grande Council of Governments of New Mexico, Albuquerque.

Henderson, City of 1984
Title 19, Planning and Zoning. City Council. Henderson, Nevada.

Henderson, City of 1985
Master Plan. Henderson, Nevada.

Henderson, City of 1986
Master Plan, Land Use Policy Plan. Henderson Planning Commission. Henderson, Nevada.

Iron, County of 1981
Land Management Code of 1981. County Planning Commission. Iron County, Utah.

Juab, County of 1977
Ordinances of Juab County, Utah, Relating to Zoning, Mobile Homes Parks, and Subdivisions of Land, Uniform Building Code, and Amendments Thereto. Juab County Center, Nephi, Utah.

Kern, County of 1986
Zoning Ordinances. Kern County, California.

Kern, County of 1986
General Plan, Land Use, Open Space, and Conservation Element, Year 2000, General Plan Program. Second Edition. Board of Supervisors. Kern County, California.

La Plata, County of 1983
Subdivision Procedures, the Land and Resource Management Program. Board of County Commissioners and Planning Commission. La Plata County, Colorado.

La Plata, County of 1984
Master Plan. County Commissioners. La Plata County, Colorado.

Las Vegas, City of 1985
General Plan, Goals, Objectives, Policies, and Programs. City Council. Las Vegas, Nevada.

Las Vegas, City of 1985
General Plan: Community Profiles, a Component of the Short-Range Plan Phase of the General Plan. City Council and Planning Commission. Las Vegas, Nevada.

Lincoln, County of 1983
Planning Program. Board of County Commissioners. Lincoln County, Wyoming.

Lincoln, County of n.d.
Developer's Packet. Office of Planning and Development. Lincoln County, Wyoming.

Lincoln, County of 1983
Minutes of Ruidoso-Lincoln County Zoning Authority Meeting of April 21, 1983. County Commissioners, Lincoln County, New Mexico.

Lincoln, County of 1984
Lincoln Historic Preservatiorn Ordinance. County Commissioner. Lincoln County, New Mexico.

Lincoln, Town of 1974
Lincoln, New Mexico, A Plan of Preservation and Growth. New Mexico State Planning Office, David King, Director. Santa Fe, New Mexico.

Mesa, County of 1985
Land Use and Development Policies. Board of Commissioners and Planning Commission. Mesa County, Colorado.

Middle Rio Grande Council of Governments of New Mexico 1982
Area-wide Comprehensive Planning Guide for Land Use Decision. Albuquerque, New Mexico.

Millard, County of n.d.
Zoning Ordinance. County Commission. Millard County, Utah.

Millard, County of n.d.
Comprehensive Development Plan. Prepared by Paul Nelson Associates for the Millard County Planning Commission. Millard County, Utah.

Mohave, County of 1976
General Development Plan. Planning and Zoning Commission. Mohave County, Arizona.

Mohave, County of 1980
Mohave Valley South, Final. Planning and Zoning Staff. Mohave County, Arizona.

Montezuma, County of n.d.
Regulation for Site Selection and Construction of Major Microwave Stations, Electric Transmission Lines, Pipelines, Power Plants, Pumping Stations, and Related Facilities, Chapter 20. Montezuma County, Colorado.

Morgan, County of 1978
Model Land Development Code Zoning and Subdivision Regulations for Utah Counties and Municipalities. Millard Consultants, publisher. Salt Lake City, Utah.

Nephi, City of 1984
Zoning Ordinance. Nephi, Utah.

New Mexico, State of 1984
Rules and Regulations Concerning the Sale, Lease, and other Dispositions of State Trust Lands. New Mexico State Land Office, Commissioner of Public Lands. Santa Fe, New Mexico.

Rio Blanco, County of 1983
Master Plan, Goals and Policies. County Planning Commission. Rio Blanco County, Colorado.

San Bernardino, County of 1976
San Bernardino: Joint Utilities Management Program. Board of Supervisors and Planning Commission. San Bernardino County, California.

San Bernardino, County of 1979
Consolidated General Plan and Implementation System. Planning Department Streamling Program and Environmental Improvement Agency. San Bernardino County, California.

San Juan, County of n.d.
Zoning Ordinance. San Juan County, Utah.

Sanpete, County of 1981
Development Code for Sanpete County. County Commission and Planning Commission. Sanpete County, Utah.

Summit, County of 1978
Master Plan. Planning Commission. Summit County, Utah.

Summit, County of 1985
The Development of Summit County. Planning Commission. Summit County, Utah.

Sweetwater, County of 1977
Final Land Use Plan. Prepared by THK Associates, Inc. for County Planning and Zoning Commission. Sweetwater County, Wyoming.

Sweetwater, County of 1986
Zoning Resolution. Board of County Commissioners. Sweetwater County, Wyoming.

Uinta, County of 1983
Background and Data for the Uinta County Comprehensive Plan, Section One Inventory and Planning Context. Uinta County, Wyoming.

Uinta, County of 1984
Comprehensive Plan. Board of County Commissioners. Uinta County, Wyoming.

Uinta, County of 1985
Land Use Resolution. Board of County Commissioners. Uinta County, Wyoming.

U.S. Dept. of Agriculture
U.S. Forest Service 1974
Kaibab National Forest Multiple Use Management Guide. Williams, Arizona.

U.S. Dept. of Agriculture
U.S. Forest Service 1984
Draft Environmental Impact Statement and Proposed Forest Land and Resources Management Plan for the Dixie National Forest. Cedar City, Utah.

U.S. Dept. of Agriculture
U.S. Forest Service 1984
Final Environmental Impact Statement for the Forest Plan, Uinta National Forest. Provo, Utah.

U.S. Dept. of Agriculture
U.S. Forest Service 1984
Forest Plan. Land and Resource Management Plan for the Uinta National Forest. Provo, Utah.

U.S. Dept. of Agriculture
U.S. Forest Service 1985
Environmental Impact Statement for the Cibola National Forest Plan. Cibola National Forest, Albuquerque, New Mexico.

U.S. Dept. of Agriculture
U.S. Forest Service 1985
Cibola National Forest Land and Resource Management Plan. Cibola National Forest, Albuquerque, New Mexico.

U.S. Dept. of Agriculture
U.S. Forest Service 1985
Public Comments and Forest Service Response to the DEIS, Proposed Cibola National Forest Plan. Cibola National Forest, Albuquerque, New Mexico.

U.S. Dept. of Agriculture
U.S. Forest Service 1985
Draft Environmental Impact Statement, Proposed Coconino National Forest Plan. Maps. Coconino National Forest, Flagstaff, Arizona.

U.S. Dept. of Agriculture
U.S. Forest Service
1985 Summary of the Draft Environmental Impact Statement for the Coconino National Forest Proposed Plan. Coconino National Forest, Flagstaff, Arizona.

U.S. Dept. of Agriculture
U.S. Forest Service 1985
Proposed Coconino National Forest Plan. Coconino National Forest, Flagstaff, Arizona.

U.S. Dept. of Agriculture
U.S. Forest Service 1985
Draft E.I.S. and Proposed Land and Resource Management Plan, Fishlake National Forest. Ogden, Utah.

U.S. Dept. of Agriculture
U.S. Forest Service 1985
A Summary of Draft Environmental Impact Statement and Proposed Land and Resource Management Plan, Fishlake National Forest. Intermoutain Region. Ogden, Utah.

U.S. Dept. of Agriculture
U.S. Forest Service 1985
Draft Environmental Impact Statement and Proposed Forest Land and Resource Management Plan for the Manti-LaSal National Forest. Price, Utah.

U.S. Dept. of Agriculture
U.S. Forest Service 1985
Wasatch-Cache National Forest Land and Resource Management Plan. Final Environmental Impact Statement. two vols. and maps. (Volume 1 - Chapters 1-5,7,Appendices; Volume 2-Chapter 6). Wasatch-Cache National Forest, Ogden, Utah.

U.S. Dept. of Agriculture
U.S. Forest Service 1985
Wasatch-Cache National Forest Land and Resource Management Plan. Forest Plan and Appendices. Wasatch-Cache National Forest, Ogden, Utah.

U.S. Dept. of Agriculture
U.S. Forest Service 1985
Record of Decision. Land and Resource Management Plan. Wasatch-Cache National Forest, Ogden, Utah.

U.S. Dept. of Agriculture
U.S. Forest Service 1986
Arizona National Forests Organization Review. Southwest Region.

U.S. Dept. of Agriculture
U.S. Forest Service 1986
Summary of Draft Environmental Impact Statement for the Kaibab National Forest Proposed Plan. Williams, Arizona.

U.S. Dept. of Agriculture
U.S. Forest Service 1986
Draft Environmental Impact Statement, Proposal Kaibab National Forest Plan. Williams, Arizona.

U.S. Dept. of Agriculture
U.S. Forest Service 1986
Proposed Kaibab National Forest Plan. Williams, Arizona.

U.S. Dept. of Interior
Bureau of Land Management 1979
Draft and Final Environmental Impact Statement, Intermountain Power Project. BLM, Utah State Office. four vols.(1st vol. is Salt Wash Proposal, 2nd vol. is Lynndyl Alternative Site, 3rd vol. is Project Alternatives, Appendices, and References, 4th vol. is Final EIS). (two copies).

U.S. Dept. of Interior
Bureau of Land Management 1980
The California Desert Conservation Area Plan. Desert District, Riverside, California.

U.S. Dept. of Interior
Bureau of Land Management 1983
Clark County Management Framework Plan. Virgin Valley-Caliente Resource Area. Las Vegas District, Las Vegas, Nevada.

U.S. Dept. of Interior
Bureau of Land Management 1983
Final Resource Management Plan Environmental Impact Statement for the Cedar/Beaver/Garfield/Antimony Planning Area. Cedar City District, Utah.

U.S. Dept. of Interior
Bureau of Land Management 1985
Draft Resource Management Plan/Environmental Impact Statement for the Kemmerer Resource Area, Kemmerer, Wyoming. Rock Springs District, Rock Springs, Wyoming.

U.S. Dept. of Interior
Bureau of Land Management 1985
Proposed Rio Puerco Resource Management Plan. Rio Puerco Resource Area, Albuquerque District, Albuquerque, New Mexico.

U.S. Dept. of Interior
Bureau of Land Management 1985
Draft Plans of Development and Rights-of-Way Grant Handbook.

U.S. Dept. of Interior
Bureau of Land Management 1986
Draft Environmental Impact Statement Proposed 1985 Amendments to the California Area Plan, Vol. 1. Californian Desert District, Riverside, California.

U.S. Dept. of Interior
Bureau of Land Management 1986
Draft Resource Management Plan/Environmental Impact Statement Warm Springs Resource Area. Richfield District, Richfield, Utah.

U.S. Dept. of Interior
Bureau of Land Management 1986
Draft Resource Management Plan/Environmental Impact Statement for the House Range Resource Area. Richfield District, Richfield, Utah.

U.S. Dept. of Interior
Bureau of Land Management n.d.
BLM and the Environment, A Review of Legislation Affecting the Bureau of Land Management.

University of Texas 1986
The University of Texas System Rate and Damage Schedule. Austin, Texas.

Utah, County of 1980
Utah County Master Plan. Board of County Commissioners. Utah County, Utah.

Utah, County of 1984
Utah County Zoning Ordinances. Board of County Commissioners, Utah County, Utah.

Utah, State of 1982
Rules and Regulations Governing the Issuance of Rights-of-Way and Rights-of-Entry. Utah Division of State Lands and Forestry.

Valencia, County of 1986
Draft Comprehensive Plan. County Commission Advisory Board. Valencia County, New Mexico.

Wasatch, County of 1973
Comprehensive Plan Wasatch County, Utah, A Summary Report of the Wasatch County Planning Commission Concerning Future Development within the Unicorporated Portions of Wasatch County. County Planning Commission. Heber, Utah.

Washington, County of 1971
Master Plan, A Part of the Washington County Master Plannning Program. Prepared by Planning and Research Associates. Salt Lake City, Utah. Washington County, Utah.

Washington, County of n.d.
A Part of the Master Plan. Prepared by John C. Wilkes and Associates, St. George, Utah. Washington County, Utah.

Wyoming, State of 1982
Rules and Regulations Governing Leasing of Sub-Surface Resources. Board of Commissioners and Wyoming Farm Loan Board. Cheyenne, Wyoming.

Refer to the Personal Communications Table for further Land Use references.

NOISE

Environmental Protection Agency 1974
Information of levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety. Washington, D.C.

National Research Council 1977
Guidelines for preparing environmental impact statements on noise. Washington, D.C.

Woodward-Clyde Consultants 1985
Application for certificate of public convenience and necessity. Mojave Pipeline Company.

CULTURAL RESOURCES

de Barros, P.L., C.E. Drover, and G.J. Bronitsky 1986
Review Draft Cultural Resources Technical Report for Mojave-Kern River-El Dorado Natural Gas Pipeline Project EIR/EIS. Submitted by Chambers Group, Inc. to the Federal Energy Regulatory Commission and the California State Lands Commission.

PALEONTOLOGICAL RESOURCES

Morales, M, E.D. Lander, and G.V. Irby 1987
Draft Paleontologic Resource Assessment Technical Report for the Proposed Mojave, El Dorado, El Paso, Transwestern, adn Kern River Natural Gas Pipelines. Submitted to Chambers Group, Inc. for the California State Lands Commission and the Federal Energy Regulatory Commission.

VISUAL RESOURCES

Elsner, G.H. and R.C. Smardon 1979
Proceedings of our national landscape: a conference on applied techniques for analysis. Berkeley, CA. U.S. Dept. of Agriculture, Pacific Southwest Forest and Range Experimental Station.

Litton, R.B., Jr. 1984
Visual vulnerability of the landscape: control and management of the visual resource. Washington, D.C. U.S. Dept of Agriculture, Forest Service.

Robinette, G.O. 1973
Energy and environment.

U.S. Dept. of Agriculture
Forest Service n.d.
Draft Environmental Impact Statement for the Dixie National Forest, Proposed Land and Resource Management Plan.

U.S. Dept. of Agriculture
Forest Service n.d.
Fishlake National Forest Proposed Land and Resource Management Plan. Intermountain Region Forest Service.

U.S. Dept. of Agriculture
Forest Service n.d.
Manti-LaSal National Forest Land and Resource Management Plan. Manti Division, Utah.

U.S. Dept. of Agriculture
Forest Service 1980
National Forest Landscape Management Vol. 2.

U.S. Dept. of Agriculture
Forest Service 1975
National Forest Landscape Management Vol. 2, Chapter 2, Utilities.

U.S. Dept. of Agriculture
Forest Service 1977
Agricultural Handbook 783, Roads. National Forest Landscape Management, Vol.2, Chapter 4.

U.S. Dept. of Agriculture
Forest Service n.d.
Visual Resource Management Implementation Plan for the Uinta National Forest.

U.S. Dept. of the Interior, BLM and California State Lands Commission; Environemental Research and Technology, Inc. 1984
Draft Environmental Impact Report an Environmental Impact Statement Porposed Celeron/All American and Getty Pipeline Projects.

U.S. Dept. of the Interior
Bureau of Land Management 1985
Draft Rio Puerco Resource Management Plan and Environmental Impact Statement, March, 1985.

U.S. Dept. of the Interior
Bureau of Land Management 1980
Visual Resource Management Program.

U.S. Dept. of the Interior
Bureau of Land Management 1981
Visual Resources Technical Report-Rocky Mountain Pipeline Project Environmental Impact Statement, July 1981.

U.S. Dept. of the Interior
Bureau of Land Management 1980
The California Desert Conservation Area Plan, 1980

U.S. Dept. of the Interior
Bureau of Land Management n.d.
Roswell Resource Area - Draft Management Framework Plan Amendment/Environmental Impact Statement.

SYSTEMS SAFETY AND RELIABILITY

Arthur D. Little, Inc. 1985
Technical Appendix M, System Safety and Reliability, Union Oil Project/Exxon Project Shamrock and Central Santa Maria Basin Area Study EIS/EIR.

City of Bakersfield Fire Deparment 1986
Letter of May 1, 1986.

Code of Federal Regulations 1985
Title 49, Parts 178 to 199. November 1, 1985.

Reese-Chambers Systems Consultants, Inc. 1984
Hazard Footprint Calculation Workbook.

Rocky Mountain Pipeline Company 1981
Final Environmental Impact Statement for the Rocky Mountain Pipeline Project. FERC Docket No. CP79-424; BLM Case No. U-45957.

Science Applications, Inc. 1983
Technical Appendix 10, System Safety Reliability for Santa Ynez Unit/Las Flores Canyon Development and Production Plan, Revised Draft Environmental Impact Statement/Report.

URS 1985
Cities Service Oil and Gas Corporation and Celeron Pipeline Company of California, San Miguel Project and Northern Santa Maria Basin Area Study Draft EIS/EIR.

U.S. Department of Transportation
Materials Transportation Bureau 1983
Annual Report on Pipeline Safety, Calendar Year 1983.

PERSONAL COMMUNICATIONS FOR THE MOJAVE-KERN RIVER-EL DORADO PIPELINE PROJECT
Land Use and Socioeconomic Research
April, 1986 through September, 1986

Name of Person Contacted	Title, Agency	Location City or County
ARIZONA		
Abraham, Judy	Kingman School District	Mohave County
Bender, Jake	Lt.,Sheriff Dept.	Yavapai County
Biggins, Judge	Seligman Fire Dept.	Yavapai County
Bird, Barbara	State Land Dept.	Phoenix
Bradley, Jo Ann	Kingman School District	Mohave County
Bruesch, Dick	Bridge Operations Engineer State Dept. of Transportation	Phoenix
Bushman, Virgil	City Fire Dept.	Joseph City
Clayburn, Marie	Chamber of Commerce	Flagstaff
Combs, Robert	Hualapai Fire Dept.	Mohave County
Connolly, Lavere	St.Johns and Concho Fire Districts	Apache County
Craig, David	Chamber of Commerce	Holbrook
Cutchen, Dave	Coconino National Forest	Flagstaff
Davis, Ken	City Fire Dept.	Ashfork
Davis, Sally	Ashfork School District	Ashfork
Denegri, Katherine	Unified Schools District	Mohave County
Deschina, Albert	Navajo Tribal Land Administration	Window Rock
Despain, Teen	Planner	Navajo County
Didion, Larry	Planner	Lake Havasu City
Dimbatt, Joyce	St. Johns School District	Apache County
Eisele, Cathy	City Fire Dept.	Holbrook
Ferroni, Leslie	Kaibab National Forest	Williams
Forrest, Jill	Flagstaff Public Schools	Coconino County
Fraley, Darlene	Joseph City School District	Navajo County
Gey, Tom	Kingman District, BLM	Kingman
Gillette, Tom	Kaibab National Forest	Williams
Holman, Judy	U.S. Fish and Wildlife Service	Phoenix
Inman, Ben	Planning and Zoning Dept.	Yavapai County
Jaramillo, Gladys	Sherrif Dept.	Apache County
Kinsey, Bill	Deputy Chief, City Fire Dept.	Kingman
Kargas, Jane	Holbrook School District	Navajo County
Kaz, Joan	Seligman School District	Yavapai County
McGregor, Andrew	Planner, Dept. of Community Development	Coconino County
McVey, Jane	Arizona Office of Tourism	Phoenix
Martin, Dennis	Marshall, City Fire Dept.	Flagstaff
Messina, Chuck	County Treasurer's Office	Yavapai County
Moss, Chris	Planning and Zoning Office	Navajo County
Newton, Dale	Superintendent, Puerco School District	Apache County
Oxford, Richard	Arizona State Lands Dept.	Phoenix
Palacios, Delores	Community Development Dept.	Navajo County
Pate, Bill	Supervisor, City Water Dept.	Flagstaff
Pearson, Keith	State, BLM	Kingman
Phillips, Don	Soil Conservation Service	Phoenix

PERSONAL COMMUNICATIONS FOR THE MOJAVE-KERN RIVER-EL DORADO PIPELINE PROJECT (continued)
Land Use and Socioeconomic Research
April, 1986 through September, 1986

Name of Person Contacted	Title, Agency	Location City or County
ARIZONA (continued)		
Russell, Jack	Centrally Valued Division, Property and Special Taxes, State Dept. of Revenue	Phoenix
Scott, Betty	Winslow School District	Navajo County
Slava, John	Planner	Coconino County
Smith, Mary Ann	City Fire Dept.	Winslow
Stansbury, Monty	Director, Planning and Zoning	Apache County
Stensrud, Cathy	Sheriff Dept.	Mohave County
Thompson, Joan	Post Office	Topock
Thomsen, Greg	Caliente Resource Area, BLM	Kern County
Tiegan, Leslie	City Planning and Zoning Dept.	Kingman
Voight, Herb	Senior Planner, County Planning Dept.	Mohave County
Weidman, Joe	Northern Arizona Council of Governments	Flagstaff
Wilbanks, Bill	Sheriff Dept.	Navajo County
CALIFORNIA		
Alexander, Bill	Captain, County Fire Dept.	Kern County
Armstrong, Virginia	Chamber of Commerce	Tehachapi
Bailey, John	Needles Resource Area, BLM	Needles
Becker, Captain	City Fire Dept.	Victorville
Belden, Val	Chamber of Commerce	Mojave
Bennett, Steven	Assistant to Commercial and Land Use Div. Tejon Ranch Company	Lebec
Brochhbuser, Jo	City Water Department	Needles
Butcher, Ronda	Chamber of Commerce	Victorville
Caballero, Connie	Chamber of Commerce	Bakersfield
Capley, Robin	Chamber of Commerce	Needles
Carr, Joseph M.	Deputy Chief, Desert Mountain Division Sheriff Dept.	San Bernardino County
Carter, Kit	Stallion Springs Resort	Kern County
Casdorph, Cheryl	Board of Supervisors	Kern County
Cassidy, Denise	State Lands Commission	Sacramento
Collins, Bill	California Desert District BLM	Riverside
Core, Floren	City Water Resources Board	Bakersfield
Coyle, Tom	Superintendent, Parks and Recreation	Kern County
DuPaul, Gene	Valuation Division, State Board of Equalization	Riverside
Foy, Mary	City Police Dept.	Needles
Gallo, Colleen	Planner	Kern County
Gamboa, Lt.	Public Information Officer, California Correctional Institute	Tehachapi
Garcia, Nora	Chairperson, Ft. Mojave Indian Reservation	Needles
Geary, Jack	Bear Valley Spring Residential Area	Kern County

PERSONAL COMMUNICATIONS FOR THE MOJAVE-KERN RIVER-EL DORADO PIPELINE PROJECT (continued)
Land Use and Socioeconomic Research
April, 1986 through September, 1986

Name of Person Contacted	Title, Agency	Location City or County
CALIFORNIA (continued)		
Gehrtz, Pam	Director of City Planning	Needles
Grider, Jake	Superintendent, County School District	Kern County
Haigh, Bill	California Desert District, BLM	Riverside
Harriman, Dick	Assistant Soil Scientist, Soil Conservation Service	Sacramento
Haynes, David	Chief, Sheriff Dept.	Kern County
Johnson, J.C.	Marine Corps (Nebo)	Barstow
Kawasaki, Frank	Forestry and Fire Warden Dept., Fire Protection Planning	San Bernardino County
Kozlowski, Janie	County School District	San Bernardino County
Lamoreaux, Wayne	City Manager	Barstow
Librarian	City Library	Boron
Lynch, Ed	Bakersfield District, BLM	Bakersfield
McCawley, Cathy	Planner	San Bernardino County
Malone, Tom	Planning Dept.	San Bernardino County
Malughney, Shirley	City Convention Bureau	Bakersfield
Mathews, Chief	City Fire Dept.	Barstow
Moesta, Joe	Lt., City Police Dept.	Bakersfield
Montaniego, Carlos Lt.	Elk Hill Naval Petroleum Reserve	Bakersfield
Musik, Pat	Environmental Health Dept.	Kern County
Purdy, Candy	Chamber of Commerce	Barstow
Querrero, Lupe	City Fire Dept.	Bakersfield
Reece, Joanne	Post Office	Newberry Springs
Rush, Chris	Recreation Planner, Barstow Resource Area, BLM	Barstow
Sanders, Dwight	State Lands Commission	Sacramento
Scull, John	California Desert District, BLM	Riverside
Straight, Steve	Head, Planning and Development Div.	Kern County
Struble, Mark	Caliente Resource Area, BLM	Bakersfield
Thompson, Ron	Southern California Water Company	Los Angeles
Vaugh, Dan	Caliente Resource Area, BLM	Bakersfield
Warner, Paul	City Planner	Barstow
Ziegler, Eric	City Police Dept.	Barstow
COLORADO		
Barkow, Lee	State Office, BLM	Denver
Bean, Mark	Planner, Planning Dept.	Garfield County
Boeschenstein, Bennett	Planner, Planning Dept.	Mesa County
Brown, Ruth	County Treasurer's Office	Rio Blanco County
Burns, Buddy	City Water Dept.	Glenwood Springs
Carmen, Leroy	Animas Fire District	La Plata County
Carr, Bill	Ute Water Conservancy	Mesa County
Carr, Gary	Public Information Office School District #51	Mesa County

PERSONAL COMMUNICATIONS FOR THE MOJAVE-KERN RIVER-EL DORADO PIPELINE PROJECT (continued)
Land Use and Socioeconomic Research
April, 1986 through September, 1986

Name of Person Contacted	Title, Agency	Location City or County
COLORADO (continued)		
Cerise, Billie	Supt. Office, RE #1 School District	Garfield County
Chaney, Dave	Rangely Volunteer Fire Dept.	Rio Blanco County
Click, Jack	City Fire Dept.	Cortez
Conley, Norma	Ignacio Public Schools	La Plata County
Cowley, Barbara	Lower Valley Fire Dept.	Mesa County
Crawford, Lem	Dolores County Volunteer Fire Dept.	Dove Creek
Cutter, Ruth	Administration Office, RE #16 School District	Garfield County
Day, Sharon	City Office	Meeker
DeWitt, Jim	City Water Dept.	Rangely
Dziewit, Barbara	Sheriff Dept.	Mesa County
Ethington, Andrea	Deputy County Assessor	Montezuma County
Evers, Capt.	City Police Dept.	Grand Junction
Evans, Fran	Bayfield Public Schools	La Plata County
Filener, Kathy	Chamber of Commerce	Rangely
Griffin, Peggy	Meeker School District	Rio Blanco County
Haley, Kermit	County Assessor's Office	Mesa County
Hastin, Shirley	County Treasurer's Office	Dolores County
Hayes, Die	Soil Conservation Service	Denver
Henderson, Yvonne	Chamber of Commerce	Glenwood Springs
Higman, Carol	Sheriff's Office	Montezuma County
Hilkey, Ron	Captain, Sheriff's Dept.	Rio Blanco County
Hogins, John	Realty Specialist, State Offices, BLM	Denver
Leion, Greg	Planning Dept.	La Plata County
Leitz, Alana	Chamber of Commerce	Grand Junction
Keelina, Robert	City Fire Dept.	Grand Junction
Keeton, Jim	Resource Area, BLM	Denver
Klein, Bob	Grand Junction District, BLM	Grand Junction
McBride, Larry	Assistant Superintendent RE #2 School District	Garfield County
McCutchen, G.W.	Service Center, City Offices	Cortez
McNutt, Billie	Dolores Public Schools	Dolores County
Magness, Wayne	Planner	Dolores County
Mason, Jim	County Volunteer Fire Dept.	Garfield County
Miller, Sally	Durango Public Schools	La Plata County
Montgomery, John	Planner	Rio Blanco County
Peterson, Charles	Senior Traffic Planner, State Highway Dept.	Denver
Pidgen, Ken	Sheriff Dept.	Garfield County
Pike, Robert	City Manager	Dove Creek
Raley, Libby	Chamber of Commerce	Meeker
Rayburn, Marlee	Chamber of Commerce	Cortez
Robbins, Dixie	Superintendent's Office Mancos Public Schools	Montezuma County
Roser, Craig	Planning Dept.	La Plata County
Stephens, Ella	County Treasurer's Office	Garfield County

PERSONAL COMMUNICATIONS FOR THE MOJAVE-KERN RIVER-EL DORADO PIPELINE PROJECT (continued)
Land Use and Socioeconomic Research
April, 1986 through September, 1986

Name of Person Contacted	Title, Agency	Location City or County
COLORADO (continued)		
Thompson, Bill	Superintendent, Cortez Public Schools	Montezuma County
Wegher, Pat	Durango Public Schoools	La Plata County
Teas, Marcie	Planner	Mesa County
Washburn, Mike	Meeker Volunteer Fire Dept.	Rio Blanco County
Weaver, Tom	Administrator	Montezuma County
White, Betty	Rangely School District	Rio Blanco County
Williams, Kayle	Dolores County School District	Dove Creek
Wilmer, Stan	Director of Finance, County Commissioner's Office	La Plata County
Woods, Scott	Southwest Colorado Economic Development District	La Plata County
Zimmerman, Jane	Chamber of Commerce	Durango
DISTRICT OF COLUMBIA		
Kenderdine, Melody	Congressman Richardson's Office	Washington, D.C.
Zimba, Elaine	Congressman Richardson's Office	Washington, D.C.
NEVADA		
Aquilar, Deborah	Chamber of Commerce	Henderson
Barnhill, Ann	Planning and Development Services	Kern County
Benoit, Dick Capt.	Public Affairs Officer	Nellis Air Force Base
Bloomquist, Gary	City Manager	Henderson
Bonar, Richard	Summa Corporation	Las Vegas
Breeden, Shirley	Personnel Office, County School District	Clark County
Burke, Bill	Resources Mangagement Specialist Lake Mead National Recreation Area	Boulder City
Calhoune, Tom	Soil Conservation Service	Carson City
Della, Nancy	City Planning Dept.	Henderson
Ditaropani, Bill	South Nevada Water System	Henderson
Donati, Judy	City Engineering Dept.	Las Vegas
Dubiel, David	Director of Community Development	Boulder City
Eginton, Don	Principal Planner, City of Las Vegas	Las Vegas
Gomczyk, Barbara	Executive Secretary to Controller	Clark County
Gorp, Van	Superintendent of Planning and Development, Parks and Recreation	Clark County
Holmes, Richard	Dept. of Comprehensive Planning	Clark County
Kesterson, Lorna	Mayor	Henderson
Laymon, Margaret	Office of Research, County School District	Clark County
Marin, Keith Ann	State Lands Office	Carson City

Land Use and Socioeconomic Research
April, 1986 through September, 1986

Name of Person Contacted	Title, Agency	Location City or County
NEVADA (continued)		
Martin, Beverly	Realty Specialist, Las Vegas District, BLM	Las Vegas
Martin, Bob	State Division of State Parks	Carson City
Maxwell, Frank	Las Vegas District, BLM	Las Vegas
Mellington, Steve	Las Vegas District, BLM	Las Vegas
Olson, Kent	City Engineering Dept.	Las Vegas
Prestwich, Leo	Superintendent, County School District	Lincoln County
Proespos, Peggy	Chief of Planning and Economic Development	Las Vegas
Reid, Bill	Las Vegas Convention and Visitors Authority	Las Vegas
Schodde, Faye	North Las Vegas Planning Dept.	Las Vegas
Sellitoe, Russell	ALCA Engineering	Henderson
Serfas, Richard	Planner	Clark County
Thom, Louella	Moapa Indian Tribe	Clark County
Tuggle, Donna	Sheriff Dept.	Clark County
Walker, Norma Jean	County Assessor's Office	Lincoln County
Wallen, Michael	Las Vegas Valley Water District	Clark County
Wilson, Bob	Senior Planner, Planning Office	Henderson
Wiseman, Richard	Rural Fire Coordinator County Fire District	Clark County
NEW MEXICO		
Allbrooks, Terry	Development Specialist Chamber of Commerce	Albuquerque
Allen, Tommie	Sheriff Dept.	Lincoln County
Archuleta, Jeanie	City Police Dept.	Socorro
Armijo, Laurel	Socorro School District	Socorro County
Atkinson, Tony	Director, County Management Office	San Juan County
Beattie, Barbara	Assistant Manager	Valencia County
Berry, Rita	Sheriff Dept.	Lea County
Boyd, Tony	City Fire Dept.	Grants
Bryant, Clara	Lovington School District	Lea County
Burger, Doug	Farmington District, BLM	Farmington
Chavez, Joe W.	Moriarty School District	Torrance County
Clem, John	Corona School District	Lincoln County
Cole, James	Planning and Zoning Officer	Socorro County
Cox, Susanna	County Manager's Office	Lincoln County
Curnett, Rocky	Socorro District, BLM	Socorro
Decker, Daryl	Chief, Fire Association	Valencia County
Dillard, David	Chamber of Commerce	Artesia
Douglas, Cecelia	Chamber of Commerce	Belen
Douglas, Jini	Supervisor, Income Support Div., State Human Services Dept.	Albuquerque
Dunlap, Daryl, Captain	Fire Dept.	San Juan County

PERSONAL COMMUNICATIONS FOR THE MOJAVE-KERN RIVER-EL DORADO PIPELINE PROJECT (continued)
Land Use and Socioeconomic Research
April, 1986 through September, 1986

Name of Person Contacted	Title, Agency	Location City or County
NEW MEXICO (continued)		
Dutton, Barbara	Chamber of Commerce	Hobbs
Eckles, Jim	Public Affairs Specialist White Sands Missile Range	White Sands Missile Range
Edmond, Mary	Manager	Socorro County
Farrel, Joel	Socorro District BLM	Socorro
Fisher, Jean	Chamber of Commerce	Grants
Frazer, Peg	Carrizozo City School District	Lincoln County
Garrett, Kathy	Ruidoso School District	Lincoln County
Gilbert, Jack	Farmington School District	San Juan County
Gonzales, Emena	City Fire Dept.	Socorro
Griffin, Jeanie	Bloomington School District	San Juan County
Harrison, Irvin	Gallup Fire Dept.	McKinley County
Hays, Leonard	Capitan School District	Lincoln County
Hays, Mary Lou	State Engineers Office	Albuquerque
Higgs, Louisa	Chamber of Commerce	Socorro
Hill, Patsy	Aztec School District	San Juan County
Hipple, Craig	State Engineers Office	Roswell
Horne, Amy	Projects Coordinator, Council of Governments	McKinley County
Hosack, Jim	Soil Conservation Service	Albuquerque
Jaramillo, Joe	Rio Puerco Resource Area, BLM	Albuquerque
Johnson, Merlene	Belen Consolidated School District	Valencia County
Jordon, Don	County Manager	McKinley County
Kelly, Pat	Roswell District BLM	Roswell
Kinney, John T.	State Offices, BLM	Santa Fe
Lambert, Judy	Tatum School District	Lea County
Leeds, Yamie	Laguna Agency	Laguna
Loutman, Mark	Director, Greater Grants Industrial Development Foundation	Cibola County
Lucero, Myra	Sheriff Dept.	Valencia County
Lutz, Rebecca	Los Lunas School District	Valencia County
McKee, Stan	Acting Area Manager, State Offices, BLM	Santa Fe
McSween, Jean	County Manager's Office	Lincoln County
Martin, Carl	Jal School District	Lea County
Miller, Patricia	Sheriff Dept.	Cibola County
Marquez, Karen	Grants School District	Cibola County
Monrreal, Michael	County Volunteer Fire Dept.	Lincoln County
Moore, Bob	Farmington District, BLM	Farmington
Neal, Jeff	Chamber of Commerce	Carlsbad
Newton, Mr.	Estancia School District	Torrance County
Pitman, Jerry	Coordinator, County Fire Districts	Lea County
Quevara, Martha	County Offices	Lincoln County
Quintana, Joe	Middle Rio Grande Council of Governments	Valencia County
Quiterrez, Lucille	Magdelena School District	Socorro County
Reneriz, Emily	Realty Specialist, Laguna Agency	Laguna
Rieley, Cathy	Mountainair School District	Torrance County

PERSONAL COMMUNICATIONS FOR THE MOJAVE-KERN RIVER-EL DORADO PIPELINE PROJECT (continued)
Land Use and Socioeconomic Research
April, 1986 through September, 1986

Name of Person Contacted	Title, Agency	Location City or County
NEW MEXICO (continued)		
Rokonsty, John	Roswell District, BLM	Roswell
Salyer, Doug	Cibola National Forest	Albuquerque
Sanchez, Albert	Southern Rio Grande Council of Governments	Socorro
Scott, Bill	Assistant Administrator	Lea County
Senn, Ray	Acting City Clerk	Socorro
Stockwell, Bob	Manager's Office	Eddy County
Traeger, Rick	Planner, San Juan Regional Committee	San Juan County
Turner, John	Central Consolidated School District	San Juan County
Vega, Yolanda	Albuquerque District, BLM	Albuquerque
Vespignani, Phyllis	County Offices	Torrance County
Vigil, Mr.	Hondo Valley School District	Lincoln County
Walling, Becky	Convention and Visitors Bureau	Farmington
Walker, June	Eunice School District	Lea County
Wheeler, Dan	State Highway Commission, Planning Division	Albuquerque
Whitney, John	State Offices, BLM	Santa Fe
Wilcox, Zelma	Chamber of Commerce	Roswell
TEXAS		
Cash, Jerry	Texas Electric Company	Ward County
Davenport, Sally	Director of Cultural Lands	Austin
Dawson, Julian	County Commissioner	Winkler County
Dumas, Carolyn	Chamber of Commerce	Monahans
Grimes, Myra	Monohans Independent School District	Ward County
Jones, Marybell	County Tax Appraiser	Loving County
Mishou, Anna	State Property Tax Board Intangibles Division, Valuation Division	Austin
Mow, Dixie	Grandfalls-Royalty School District	Ward County
Sitz, Richard	County Judge	Monhans
Skinner, Dorothy	Executive Director, Chamber of Commerce	Kermit
Smith, Nita	Chamber of Commerce	Pecos
UTAH		
Adams, Greg	Planner	San Juan County
Adams, Ken	County Commissioner	Morgan County
Argyle, Brent	Chief, South Davis Fire District	Bountiful
Bailey, Rick	Assistant to County Commission	San Juan County
Balling, Jack	City Engineer	Bountiful
Barnes, Jerry	Planning Director	Salt Lake City
Bayless, Marion	County Treasurer	San Juan County
Beck, Wayne	County Clerk	Sanpete County
Black, Burdell	City Public Utilities Dept.	Provo

PERSONAL COMMUNICATIONS FOR THE MOJAVE-KERN RIVER-EL DORADO PIPELINE PROJECT (continued)
Land Use and Socioeconomic Research
April, 1986 through September, 1986

Name of Person Contacted	Title, Agency	Location City or County
UTAH (continued)		
Blackman, Ross	Planner	Sanpete County
Boman, Wes	Director, Chamber of Commerce	Brigham City
Bradshaw, Gloria	Statistician, Public Utilties Dept.	Salt Lake City
Brinkerhoff, Ronda W.	Bureau of Economic and Business Research, College of Business, University of Utah	Salt Lake City
Burton, Barry	Planner, County Planning Dept.	Davis County
Carter, Inez	Personnel Dept., County School District	Davis County
Chamberlain, Sylvia	County Public School District	Iron County
Chappell, Robin	Sheriff Dept.	Utah County
Chopyk, Bill	Planner, General Services Division	Summit County
Christen, Carol	Superintendent's Office, County School District	Davis County
Christian, Clyde	City Water Dept.	Monticello
Christianson, Clyda	Superintendent's Office, County School District	San Juan County
Cron, Bob	Wasatch-Cache National Forest	Salt Lake City
Crook, Wayne	Assistant Superintendent, County School District	Beaver County
Curtis, Dennis	Cedar City District, BLM	Cedar City
Davis, Helen	Acting County Treasurer	Grand County
De Giorgio, Joan	State Office of Planners and Budget	Salt Lake City
Duncan, Loretta	Fire Dept.	Utah County
Edwards, Dave	District 7, BLM	Salt Lake City
Eson, Marion	Grand County Travel Council	Moab
Fawcett, Allen	Economic Development Division, Six County Association of Governments	Richfield
Fitzgerald, Gwen	South Summit School District	Summit County
Gale, Russell	County Building and Zoning Inspector	Beaver County
Gallegos, Mike	County Commission	Salt Lake County
Garfield, Mrs.	Chamber of Commerce	Cedar City
Godfrey, Andy	Fishlake National Forest	Richfield
Goheen, Deon	Planning Dept.	Washington County
Gottfredson, Paul	South Sanpete County Schools	Sanpete County
Greenhalgh, Faye	City Offices	Nephi
Greenhalgh, Glen	City Office of Economic Development	Nephi
Grover, Barbara	Alpine School District	Utah County
Harvey, Richard	City Health Dept.	Salt Lake City
Harr, Leslie	Utah Travel Council	Salt Lake City
Heaton, Garth	Utah Energy Coordinator, Utah National Forest	Salt Lake City
Herron, Lana	County Clerk	San Juan County
Hess, J.W.	Treasurer, South Davis Water District	Davis County
Higgs, Lance	Dept. of Public Works	Heber City
Hiskey, John	Director, Economic Development Services	Salt Lake City

PERSONAL COMMUNICATIONS FOR THE MOJAVE-KERN RIVER-EL DORADO PIPELINE PROJECT (continued)
Land Use and Socioeconomic Research
April, 1986 through September, 1986

Name of Person Contacted	Title, Agency	Location City or County
UTAH (continued)		
Hulet, Carma	County Offices	Iron County
Humphreys, Peggy	San Juan County Travel Council	Monticello
Ison, Dan	City Police Dept.	Moab
Ivers, Rosalie	Wasatch County Public Schools	Heber City
Johnson, Gayle	County Clerk	San Juan County
Johnson, Norman	City Offices	Blanding
Johnson, Teresa	City Water Dept.	Logan
Jones, Nola	City Offices	Heber City
Kappe, Karl	Planner, State Lands Office	Salt Lake City
Kofford, Paul	Fire Commissioner, South Summit Fire Protection District	Summit County
Lessina, Hal	City Water Dept.	Beaver
Lewis, Claudia	Cache Chamber of Commerce	Logan
McArthur, Wayne	City Public Utitlites Dept.	St. George
McArthur, Dahl	Hooper Water District	Davis County
McKnight, Randy	City Public Works Dept.	Nephi
McNeeley, Dick	Planning Dept.	Salt Lake County
Mathis, Robert	County Planner	Wasatch County
May, Chad	Building Inspector and Zoning Administrator	Iron County
Miller, Linda	Grand County Public Schools	Moab
Olson, Eldon	City Public Works Dept.	Orem
Nelson, Major	Camp Williams Camp Administration	Salt Lake City
Nielson, Niel	Research Specialist, Provo Economic Development Dept.	Utah County
Palmer, Phil		Blanding, San Juan County
Pendleton, Don	Richfield District, BLM	Richfield
Peterson, Jerry	North Summit School District	Summit County
Peterson, Norma	Ogden Area Chamber of Commerce	Davis County
Peterson, Stevan H.	Superintendent, County Schools	Washington County
Prane, Kevin	Personnel Office, Provo School District	Utah County
Quilter, Claire	Salt Lake District, BLM	Salt Lake City
Rawlinson, Ralph	Dixie National Forest	Cedar City
Reagan, Jerry	County Planner and Building Inspector	Millard County
Reed, Thelma	Superintendent's Office, Juab County School District	Juab County
Ricks, Clain	Land Use Manager, Planning Dept.	Salt Lake City
Rindlisbacher, Alan	Salt Lake Area Chamber of Commerce	Salt Lake County
Robertson, Jim	Supervisor, City Utilities Dept.	Ogden
Rowley, Jan	Visitors and Convention Bureau	Salt Lake City
Sampson, Bill	Business Administrator, Park City School District	Park City
Schocknmyer, Emil	City Sewer Dept.	Moab
Scow, Joanne	Sheriff Dept.	Washington County
Shelley, Penny	Chamber of Commerce	St. George

PERSONAL COMMUNICATIONS FOR THE MOJAVE-KERN RIVER-EL DORADO PIPELINE PROJECT (continued)
Land Use and Socioeconomic Research
April, 1986 through September, 1986

Name of Person Contacted	Title, Agency	Location City or County
UTAH (continued)		
Smith, Gale	Public Relations Dept., Sheriff Dept.	Davis County
Smith, Garth	Planning Dept	Utah County
Smith, Jerry	Uinta National Forest	Provo
Smith, Linda	Sheriff's Dept.	Summit County
Smouse, Vali	Planner	Grand County
Snyder, Maggie	City Water Dept.	Moab
Sperry, Gale	County Offices	Juab County
Stanton, Betty	Chamber of Commerce	Moab
Stewart, Karen	Commission for Economic Development of Orem	Orem
Strate, Rudy	North Sanpete County Schools	Sanpete County
Strebel, Stan	General Services Dept.	Summit County
Taylor, La Rue	Nebo School District	Utah County
Tong, Lou	Commissioner	Iron County
Tummons, Richard	Soil Conservation Service	Salt Lake City
Turner, Judy	Sheriff's Office	Iron County
Vetterli, Gary	Fire Protection District	Park City
Vest, Virginia	Personnel Office, Nebo School District	Utah County
Ward, Jim	District Manager, Moab District BLM	Moab
Warner, Reed	North Summit Fire Protection District	Summit County
Watson, Tim	Kamas Valley Soil Conservation District	Coalville
Waymont, Dal	South Davis Sewer District	Davis County
Whittwer, Cherie	City Public Works Dept.	Brigham City
Wilkenson, Sherm	Director, County Economic Development	Salt Lake County
Willey, John	Planner	Washington County
Williams, John	Executive Director, Five County Association of Governments	St. George
Wright, Len	County Assessor	Juab County
Zeller, Dean	Salt Lake District, BLM	Salt Lake City
WYOMING		
Ady, Mrs.	Public Lands Office	Cheyenne
Arbeiter, Pat	Kemmerer District, BLM	Kemmerer
Bafa, Helen	Chamber of Commerce	Rock Springs
Barrera, Pam	County Assessor's Office	Sweetwater County
Bernatis, Kathy	School District #1	Sweetwater County
Bigelow, Dolores	School District #2	Sweetwater County
Block, Mary Lou	School District #6	Uinta County
Bromagen, June	Wyoming Travel Commission	Cheyenne
Canady, Carol	Rock Springs Volunteer Fire Dept.	Sweetwater County
Clevanger, Bob	Green River Volunteer Fire Dept.	Lincoln County
Ernie, Mrs.	Planning Division	Uinta County
Fagmant, Georgene	School District #4	Uinta County
Farley, Dennis	City Planner	Evanston

PERSONAL COMMUNICATIONS FOR THE MOJAVE-KERN RIVER-EL DORADO PIPELINE PROJECT (continued)
Land Use and Socioeconomic Research
April, 1986 through September, 1986

Name of Person Contacted	Title, Agency	Location City or County
WYOMING (continued)		
Harvey, David	County Treasurer	Lincoln County
Hicks, Jay	Supervisor, Water Dept., Pacific Power and Light Co.	Rock Springs
Hudson, Rachel	Superintendent's Office, School District #1	Uinta County
Janway, Jolene	Property Tax Clerk	Uinta County
Kimmel, Paul	State Lands Commission	Cheyenne
Lunsford, John	Chief, Uinta County Fire Dept.	Evanston
Malicoat, Karen	Chamber of Commerce	Green River
Palmer, Mildred	Chamber of Commerce	Evanston
Peverley, Sue	County Treasurer's Office	Sweetwater County
Reed, Jean	Office of Planning and Development	Lincoln County
Sayre, Jim	Long Range Planner	Lincoln County
Swanson, Dave	City Public Works Dept.	Kemmerer
Uhrich, Ken	Ad Valoren Tax Division Dept. of Revenue and Taxation	Cheyenne
Watson, Steve	Planner	Sweetwater County
Welling, Don	Clerk, Planning and Zoning Dept.	Evanston
Young, Jack	Soil Conservation Service	Casper

GLOSSARY

GLOSSARY

Aftershock. An earthquake which follows a larger earthquake and originates at or near the focus of the larger earthquake.

Airshed. A geographic area that shares the same air because of topography, meteorology, and climate.

Allotment. An area of land where one or more permittees graze their livestock. Generally consists of public land but may include parcels of private or State lands. The number of livestock and season of use are stipulated for each allotment. An allotment may consist of several pastures or be only one pasture.

Alluvial fan. A sloping, fan-shaped mass of sediment deposited by a stream or drainageway where it emerges from a mountain front onto a plain.

Alkali. Any soluble mineral salt or mixture of salts found in soils, as in some deserts, and capable of neutralizing acids.

Animal unit month (AUM). The amount of forage necessary for the sustenance of one cow or five sheep for one month.

Areas of Critical Environmental Concern (ACEC). Areas within the public lands (BLM) where species management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards.

Arroyo. The channel of an ephemeral or intermittent stream, usually with vertical banks of unconsolidated material.

Artesian. Groundwater which is under sufficient pressure (always greater than atmospheric) to rise above the top of the aquifer when tapped by a well.

Aquifer. A water-bearing bed or layer of permeable rock, sand, or gravel, capable of yielding water.

Blowout. The general term for various trough-shaped hollows formed by wind erosion on a preexisting dune or other sand deposit.

Community. An aggregate of organisms that form a distinct ecological unit. Such a unit may be defined in terms of plants, animals, or both.

Conifer. Cone bearing trees such as pine, spruce, and fir.

Critical wildlife habitat. That portion of wildlife habitat that is essential to the survival and perpetuation of threatened and endangered species as designated by the U.S. Fish and Wildlife Service.

Cultural Resource. The remains of sites, structures, or objects used by humans in the past.

Designated corridor. A linear area of land with defined and recognized boundaries identified and designated by legal public notice.

Developed recreation site. Relatively small, distinctly defined area where facilities are provided for concentrated public use, i.e., campgrounds, picnic areas, swimming areas.

Ecotype. A distinct population of organisms within a species that has adapted genetically to its local habitat.

Endangered animal species. Any animal species in danger of extinction throughout all or a significant portion of its range. This definition excludes species of insects that the Secretary of the Interior determines to be pests and whose protection under the Endangered Species Act of 1973 would present an overwhelming and overriding risk to man.

Endangered plant species. Species of plants in danger of extinction throughout all or a significant portion of their ranges. Existence may be endangered because of the destruction, drastic change, or severe curtailment of habitat, or because of overexploitation, disease, predation, or even unknown reasons. Plant taxa from very limited areas (e.g. the type localities only), or from restricted fragile habitats usually are considered endangered.

Erosion. The removal, detachment, and entrainment of earth materials by weathering, dissolution, abrasion, and corrosion, later to be transported by moving water, wind, gravity, or glaciers.

Fault. A fracture in rock or strata along which two sides have been displaced relative to one another parallel to the fracture.

Fauna. The animals of a specified region or time.

Floodplain. The flat ground along a stream covered by water at the flood stage.

Flora. The plants of a specified region or time.

Forage. Vegetation of all forms available for animal consumption.

Forb. A broad-leafed herb other than grass; a weed.

Game Species. Any species of wildlife or fish for which seasons and bag limits have been prescribed and which are normally harvested by hunters, trappers, and fishermen under state or federal laws, codes, or regulations.

Habitat. A specific set of physical conditions that surround a single species, a group of species, or a large community. In wildlife management, the major components of habitat are considered to be food, water, cover, and living space.

Hack Site. A man-made resting area for peregrine falcons.

Impact. A change in the ecosystem resulting from or accelerated by human action.

Lek. A courtship/breeding ground for sage grouse.

Management Framework Plan (MFP). A land use plan for public lands (BLM) which provide a set of goals, objectives and constraints for a specific planning area to guide the development of detailed plans for the management of each resource.

Mitigation. The abatement or reduction of an impact to the environment by (1) avoiding a certain action or parts of an action, (2) employing certain construction measures to limit the degree of impact, (3) restoring an area to preconstruction conditions, (4) preserving or maintaining an area throughout the life of a project, or (5) replacing or providing substitute resources to the environment.

National Environmental Policy Act (NEPA). An act to declare a national policy which will encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man, to enrich the understanding of the ecological systems and natural resources important to the Nation and to establish a Council on Environmental Quality.

Nongame Species. Wildlife which is not hunted for recreational purposes.

Off-road vehicle (ORV). A vehicle (including four-wheel drive, trail bikes, and snowmobiles but excluding helicopters, fixed-wing aircraft, and boats) capable of traveling off-road over land, water, ice, snow, sand, marshes, and other terrain.

Particulates. Small particles suspended in the air and generally considered pollutants.

Physiography. The study of genesis and evolution of landforms.

Playa. The shallow central basin of a desert plain, in which water gathers after a rain and is evaporated.

Precipitation. As used in hydrology, precipitation is the discharge of water, in liquid or solid state, out of the atmosphere, generally upon a land or water surface.

Raptor. Living on prey; a group of carnivorous birds consisting of hawks, eagles, falcons, vultures, and owls.

Recreation Opportunity Spectrum (ROS). A method of measuring the ability of Forest Service land to meet the various types of demands imposed by a variety of recreation uses.

Resource Management Plan. A plan developed prior to the Forest Plan outlining the activities and projects for a particular resource element independent of considerations for other resources. Such plans are superceded by the Forest Plan.

Right-of-way. The legal right for use, occupancy, or access across land or water areas for a specified purpose or purposes.

Riparian. Situated on or pertaining to the bank of a river, stream, or other body of water. Normally used to refer to the plants of all types that grow along or around springs.

Riprap. Stone placed on earth surfaces such as the face of a dam or bank of a stream, for their protection against the action of waves.

Saline. Containing common salt or any of the salts of alkali metals or magnesium.

Sediment. Soil or mineral transported by moving water, wind, gravity, or glaciers, and deposited in streams or other bodies of water, or on land.

Seismic. Pertaining to an earthquake or earth vibration, including those that are artificially induced.

Significant impact. A meaningful standard to which an action may impact the environment. The impact may be beneficial, adverse, direct, indirect, or cumulative, and may have short-term or long-term effects.

Silt. Any earthy material composed of fine particles, smaller than sand but larger than clay, suspended in or deposited by water.

Species. (1) The classification level of biological nomenclature which categorized each group of related organisms potentially capable of interbreeding; (2) the accepted level of classification to differentiate one specific type of organism from another.

Subsidence. (1) The sinking of a large part of the earth's crust. (2) Geologic movement in which there is no free side and the surface material is displaced vertically downward with little or no horizontal component.

Talus. A collection of fallen disintegrated material which has formed a slope at the foot of a steeper declivity.

Threatened animal species. Any animal species likely to become endangered within the foreseeable future throughout all or a significant part of its range.

Threatened plant species. Species of plants that are likely to become endangered within the foreseeable future throughout all or a significant portion of their ranges, including species categorized as rare, very rare, or depleted.

Topography. The features of the earth, including relief, vegetation, and waters.

Vegetation. Plants in general or the sum total of the plant life above and below ground in an area.

Visual Quality Objective (VQO). Categories of acceptable landscape alteration measured in degrees of deviation from the natural-appearing landscape (Forest Service).

Visual Resource. The composite of basic terrain, geologic features, water features, vegetative patterns, and land-use effects that typify a land unit and influence the visual appeal the unit may have for visitors.

Visual Resource Management (VRM). The planning design and implementation of visual resource management classes for all BLM resource management activities.

Watershed. The entire area that contributes water to a drainage system or stream.

Water table. The upper limit of the portion of the ground that is wholly saturated with water.

Wetlands. Swamp or marshes, especially as an area preserved for wildlife.

Wildlife. All species of mammals, birds, fish, amphibians, and reptiles found in a wild state.

Wildlife habitat. All elements of a wild animal's environment necessary for completion of its life cycle. These elements include food, cover, water, and living space.

ABBREVIATIONS

Abbreviations

AFFTC	Air Force Flight Test Center
ACHP	Advisory Council of Historic Preservation
ACEC	Area of Critical Environmental Concern
ADFG	Arizona Department of Fish and Game
AIRFA	American Indian Religious Freedom Act
AUM	Animal Unit Months
BACT	Best Available Control Technology
BLM	Bureau of Land Management
CAA	Clean Air Act
CARB	California Air Resources Board
CDCA	California Desert Conservation Area
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CIG	Colorado Interstate Gas Company
CLE	Contingency Level Earthquake
CNPS	California Native Plant Society
CO	Carbon Monoxide
CUP	Central Utah Project
dBA	Decibels on a weighted scale
DOD	Department of Defense
EOR	Enhanced Oil Recovery
EPA	Environmental Protection Agency
ERT	Environmental Research and Technology, Inc.
ESA	Environmental Study Area
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FMIR	Fort Mojave Indian Reservation
FS	Forest Service
HABS	Historic American Building Survey
IPP	Intermountain Power Project
ISA	Instant Study Area
ISC	Industrial Source Complex
ISZ	Intermountain Seismic Zone
JUMP	Joint Utilities Management Program
KRGT	Kern River Gas Transmission Company
LAER	Lowest Achievable Emission Rate
l_{dn}	day-night sound levels
MAPCO	Mid America Rocky Mountain Liquid Hydrocarbons Pipeline Company
MFR	Mountain Fuel Resources, Inc.
MMcfd	One million cubic feet per day
MOP	Maximum Operating Pressure
MP	Milepost
NAAQS	National Ambient Air Quality Standards
NA	Nonattainment Area
NAP	Nonattainment Plan
NEPA	National Environmental Policy Act
NGPSA	Natural Gas Pipeline Safety Act
NMDGF	New Mexico Department of Game and Fish
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NO_x	Nitrogen Oxide

Abbreviations (continued)

NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
NRA	National Recreation Area
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NSR	New Source Review
NWR	National Wildlife Refuge
O_3	Ozone
OLE	Operating Level Earthquake
OPC	Overthrust Pipeline Company
PG&E	Pacific Gas and Electric Transmission Company
PGT	Pacific Gas Transmission Company
PARIS	Plume-Airshed Reactive-Interacting System
ppm	parts per million
pphm	parts per hundred million
PSD	Prevention of Significant Deterioration
R-E-D Code	Rarity-Endangered-Distribution
RMPP	Rocky Mountain Pipeline Project
ROS	Recreation Opportunity Spectrum
ROW	right-of-way
SCADA	Supervisory Control and Data Acquisition
SCRA	State of California Resource Agency
SCS	Soil Conservation Service
SEDAB	Southeast Desert Air Basin
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SLC	State Lands Commission
SoCal	Southern California Edison Company
StanPac	Standard Pacific Gas Line, Inc.
TSP	Total Suspended Particulates
UDWR	Utah Division of Wildlife Resources
ug/m^3	micrograms per cubic meter
UPA	Unusual Plant Assemblage
UP&L	Utah Power and Light Company
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VAC	Visual Absorption Capacity
VQO	Visual Quality Objective
VRM	Visual Resource Management
WGF	Wyoming Game and Fish
WSA	Wilderness Study Area

LIST OF PREPARERS

LIST OF PREPARERS

Name	Responsibility or Title
California State Lands Commission	
Mary Griggs	Environmental Project Manager
Diana Jacobs	Terrestrial Biology
Federal Energy Regulatory Commission	
Robert Arvedlund	Environmental Project Director
John Leiss	Mojave/El Dorado Project Manager
Larry Sauter	Kern River Project Manager
Mark Jensen	Land Use, Socioeconomics, Visual Resources, Soils
Patti Leppert-Slack	Aquatic and Terrestrial Biology, Water Resources
Lonnie Lister	Geology, Water Resources
Daniel Norden	Air and Noise Quality
Lauren O'Donnell	Alternatives, Cultural and Paleontological Resources
John Roddy	Legal Counsel
Deborah Vrabel	Cultural Resources
Chambers Group, Inc.	
M.D. Chambers	President, Principal-in-Charge
Dr. Kenneth J. Lord	Project Manager
DiAnne Valentine	Task Manager, Land Use; Cartographer
Nancy S. Cella	Research Associate: Cultural Resources, Socioeconomics, Recreation, Traffic; Editor
Teri Van Huss	Supervisor, Report Production
Eileen Campisi	Financial Coordinator
Robin M. King	Word Processing
Pam Finch	Word Processing
Ronald Kneebone	Cartography Assistance
Dr. Philip de Barros	Task Manager, Cultural Resources and Paleontology
Dr. Chris Drover	Technical Report, Great Basin
Dr. Gordon Bronitsky	Technical Report, NM and AZ
Beth Sennett-Walker	Research Associate (WY, CO, NV)
Farron Webb	American Indian Concerns, Navajo and Laguna Tribes
Glenn Russell	Research Associate
Nicholas Trierweiler	Research Associate
James Miller	Research Associate

LIST OF PREPARERS (continued)

Name	Responsibility or Title

GEOLOGY, SOIL, SURFACE WATER, GROUNDWATER, FRESHWATER BIOLOGY, TERRESTRIAL BIOLOGY

Bio/West, Inc.

Name	Responsibility or Title
Dr. Tom Twedt	Deputy Project Manager
Oliver Grah	Task Manager - Vegetation, Soils, Water Resources, and Geology
Dr. Roy Hugie	Task Manager - Wildlife, Grazing, Biological Assessment,
William Glenn	Soils
Randall Gainer	Geology
Dr. Loren Anderson	Geology
Richard White	Groundwater
Karen Rice	Geology, Groundwater
Larry Crist	Freshwater Biology
Dr. Elizabeth Neece	Vegetation
Frank Smith	Vegetation
William Masslich	Vegetation, Wildlife
S. Blaise Chanson	Wildlife, Field Surveys
Anne Flannery	Wildlife
Miriam Rand	Technical Editor
Roni Pekins	Technical Editor
Gerald Hughes	Cartography

Earth Facts

Name	Responsibility or Title
Randy Gaynor	Surface Water and Groundwater
John Keith	Surface Water and Groundwater

AIR QUALITY

Applied Modeling, Inc. (Air Quality Modeling)

Name	Responsibility or Title
Khanh T. Tran	Task Manager
Prasanta Bhunia	Reactive Modeling
Richard Manz	Inert Modeling
Fabrice Cuq	Reactive Modeling
Sunil Jambusana	Inert Modeling

Jacobs Engineering (Air Quality Emissions)

Name	Responsibility or Title
Hamid Rastegar	Task Manager
Jim Goepel	Inventory

LIST OF PREPARERS (continued)

Name	Responsibility or Title
SYSTEM SAFETY AND RELIABILITY	
Reese-Chambers Systems Consultants	
Tim Chambers	System Pipeline Analysis
SOCIOECONOMICS	
Leviathan Associates	
Dr. David Rockland	Task Manager
Pam Rockland	Research Associate
PALEONTOLOGY	
Museum of Northern Arizona	
Dr. Michael Morales	Co-Task Manager
Dr. E. Bruce Lander	Technical Report Co-Author
Grace V. Irby	Technical Report Co-Author
Dr. Spencer G. Lucas	Research Associate, NM, TX
Dr. Wade Miller	Research Associate, UT
Jeffrey G. Eaton	Research Associate, WY, CO and eastern Utah
Kenneth R. Thiessen	Research Associate, AZ
VISUAL RESOURCES	
Takata Associates	
Robert Takata	Task Manager
James Fraser	Project Manager
Jeannie Lau	Project Planner

VOLUME I

appendices

APPENDIX A

CHARACTERISTICS OF THE SOIL MAPPING UNITS

- A-1 Mojave Pipeline Proposal
- A-2 El Dorado Pipeline Proposal
- A-3 El Paso Expansion Proposal
  - a Base Case
  - b 600 MMcfd Alternatives
  - c Northwest Expansion Project
- A-4 Transwestern Expansion Proposal

APPENDIX A-1 CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE MOJAVE PIPELINE PROPOSAL

Milepost	Soil Mapping Unit	Soil Series	Slope (%)^{a}	Depth Class^{f}	Texture^{b}	Erosion Potential Water^{c}	Erosion Potential Wind^{d}	Reclamation Potential Limitations^{e}	Cropland
Mojave Transfer Line Basin & Range Physiographic Province									
0-16.5	Rositas-Gunsight Association: Deep, somewhat excessively drained, sandy and very gravelly soils; on sloping to moderately steep fan terraces.	Rositas	5-35	D	Sand	L-H	H	Poor: sandy texture	None
		Gunsight	2-35	D	Very gravelly loam	L-H	L	Fair to Poor: very gravelly and stony	None
Mojave Mainline									
0-128.5	Mojave Desert: Landscapes include stream terraces and floodplains, old and recent alluvial fans, desert pavement on older alluvial fans, basin floor and rims, and playas	Garlock	2-9	VD	Loamy sand to sandy clay loam	L	H	Fair: sandy texture	None
		Cajon	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
		Halloran	0-2	VD	Sand, sandy loam	L	H	Poor: sandy texture, saline/alkaline	
		Manet	0-9	VD	Sand, loamy sand	L	H	Poor: sandy texture	None
		Rosamond	0-2	VD	Loam, clay loam	L	H	Poor: high salinity/alkalinity	None
		Bousic	0-1	VD	Clay	L	M	Poor: high salinity/alkalinity and clayey texture	None
		Unnamed (playas)	0-1	VD	Variable	L	M	Poor: high salinity/alkalinity	None
		Villa	0-2	VD	Loamy sand	L	H	Poor: sandy texture	None
		Victorville	0-2	VD	Sandy loam	L	M	Fair: sandy texture	None
		Unnamed (desert pavement)	0-5	MD-D	Silt loam, clay loam	L	M	Fair: coarse fragments	None
128.5-129.5	Playas-Bousic: Associations: Playas and very deep, nearly level, moderately well-drained soils on basin rims	Playas	0-1	VD	Variable	L	M	Poor: high salinity/alkalinity	None
		Bousic	0-1	VD	Clay	L	M	Poor: high salinity/alkalinity and clayey texture	None
129.5-138 166-176	Halloran-Cajon, loamy substratum Norob Association: Very deep, nearly level and gently sloping, somewhat excessively drained and moderately well-drained soils on terraces and alluvial fans	Halloran	0-2	VD	Loamy sand, sandy loam	L	H	Poor: saline/alkaline	None
		Cajon, loamy substratum	0-2	VD	Sand, loamy sand, over loamy	L	H	Poor: sandy texture	None
		Norob	0-5	VD	Sandy clay loam	L	M	Poor: saline/alkaline	None
138-140	Villa-Riverwash-Victorville Association: Very deep, nearly level, moderately well-drained soils on floodplains and low terraces; also Riverwash	Villa	0-2	VD	Loamy sand, sandy loam	L	H	Poor: sandy texture	None
		Riverwash	0-2	VD	Sand	-	-	-	
		Victorville	0-2	VD	Sandy loam, loamy sand	L	M	Fair: sandy texture	None
140-142.5 143.5-153 154-161 164-166	Cajon-Manet Association: Very deep, nearly to strongly sloping, somewhat excessively drained and well-drained soils on recent alluvial fans	Cajon	0-15	VD	Sand, loamy sand	L	H	Poor: sandy texture	None
		Manet	0-9	VD	Sand, loamy sand	L	H	Poor: sandy texture	None

APPENDIX A-1 CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE MOJAVE PIPELINE PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)^a	Depth Class^f	Texture^b	Erosion Potential		Reclamation Potential Limitations^e	Cropland
						Water^c	Wind^d		
142.5-143.5 153-154	Rock Outcrop-Lithic Torriorthents-Sparkhule Association: Rock outcrop; and very shallow and shallow, moderately steep to steep well-drained soils on desert foothills and mountains	Rock Outcrop	>50	-	Rock	-	-	-	
		Lithic Torriorthents	15-50	VS-S	Sandy loam, very gravelly sand	M-VH	L-M	Poor: quantity	None
		Sparkhule	15-50	S	Gravelly sandy loam, sandy clay loam	M-VH	L	Poor: quantity and slope	None
161-164	Rosamond-Lavic-Cave Association: Very deep and shallow, nearly level and gently sloping, moderately well-drained and well drained soils on basin rims and low alluvial fans	Rosamond	0-2	VD	Loam, clay loam, loamy sand	L	M	Poor: high salinity/alkalinity	None
		Lavic	0-5	VD	Loamy sand, sandy loam	L	H	Fair: sandy texture, high lime	None
		Cave	0-2	S	Loam over a hardpan	L	M	Poor: quantity	None
176-184	Mojave Desert: Landscapes include stream terraces and floodplains, old and recent alluvial fans, desert pavement on older alluvial fans, basin floor and rims, and playas	Garlock	2-9	VD	Loamy sand to sandy clay loam	L	H	Fair: sandy texture	None
		Cajon	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
		Halloran	0-2	VD	Sand, sandy loam	L	H	Poor: sandy texture, saline/alkaline	
		Manet	0-9	VD	Sand, loamy sand	L	H	Poor: sandy texture	None
		Rosamond	0-2	VD	Loam, clay loam	L	H	Poor: high salinity/alkalinity	None
		Bousic	0-1	VD	Clay	L	M	Poor: high salinity/alkalinity and clayey texture	None
		Unnamed (playas)	0-1	VD	Variable	L	M	Poor: high salinity/alkalinity	None
		Villa	0-2	VD	Loamy sand	L	H	Poor: sandy texture	None
		Victorville	0-2	VD	Sandy loam	L	M	Fair: sandy texture	None
		Unnamed (desert pavement)	0-5	MD-D	Silt loam, clay loam	L	M	Fair: coarse fragments	None
184-191 199-204	Cajon-Arizo-Alko Association: Very deep and shallow, nearly level to strongly sloping, well-drained and excessively drained soils on alluvial fans, alluvial plains, and old terraces	Cajon	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
		Arizo	2-9	VD	Gravelly loamy sand	L	H	Poor: gravelly texture; sandy texture	None
		Alko	0-9	S	Sandy loam over a hardpan	L	M	Poor: quantity	None
191-199 204-205	Norob-Neuralia Association: Very deep and deep, nearly level and gently sloping, well-drained soils on alluvial fans and plains	Norob	0-5	VD	Sandy clay loam	L	M	Poor: saline/alkaline	None
		Neuralia	2-5	D	Sandy loam, sandy clay loam	L	M	Good: none	None
205-207.5 214-221 226-228	Garlock-Nerualia Association: Very deep and deep, nearly level to moderately sloping, well-drained soils on old stream terraces, alluvial fans and alluvial plains	Garlock	2-9	VD	Loamy sand to sandy clay loam	L	H	Fair: sandy texture	None
		Neuralia	2-5	VD	Sandy loam, sandy clay loam	L	M	Good: None	None

APPENDIX A-1 CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE MOJAVE PIPELINE PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)^a	Depth Class^f	Texture^b	Erosion Potential Water^c	Erosion Potential Wind^d	Reclamation Potential Limitations^e	Cropland
207.5-213	Randsburg-Muroc Association: Shallow, gently sloping to strongly sloping, well-drained soils on low pediments	Randsburg	2-15	S	Sandy loam	L-M	M	Poor: quantity	None
		Muroc	2-9	S	Sandy loam over a hardpan	L	M	Poor: quantity	None
213-214 223-226	Cajon: Very deep, nearly level to strongly sloping, somewhat excessively drained soils on alluvial fans and plains	Cajon	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
221-223	Rosamond-DeStazo Association: Very deep, nearly level to moderately sloping, well-drained soils; on flood plains and in basins	Rosamond	5-15	VD	Clay loam, loam	L-M	M	Good to Poor: sometimes saline/alkaline	None
		DeStazo	0-2	VD	Very gravelly sandy loam to clay loam	L	M	Fair to Poor: gravels, high lime	None
Tehachapi Mountains Area									
228-232	Pajuela-Whitewolf Association: Very deep, nearly level to steep, somewhat excessively drained soils on old stream terraces, alluvial fans, and flood plains	Pajuela	30-50	D	Very gravelly loamy sand	H-VH	M	Poor: gravelly texture, slope	None
		Whitewolf	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
232-233	Rock Outcrop-Jawbone-Xeric Torriorthents Association: Rock outcrop and shallow, hilly to very steep, well-drained and somewhat excessively drained soils on mountainous uplands	Rock outcrop	50-75	-	Rock	-	-	-	
		Jawbone	15-75	VS	Gravelly loamy sand	M-VH	H	Poor: quantity, slope	None
		Xeric Torriorthents	50-85	S	Gravelly loamy texture	H-VH	M	Poor: quantity, slope	None
233-239 241-242 243-248 249-253	Walong-Anaverde-Edmundston Association: Very deep to moderately deep, hilly to very steep, well-drained soils underlain by weathered granite or schist; on mountainous uplands	Walong	15-30	MD	Sandy loam	M-H	M	Fair to Poor: slope, quantity	None
		Anaverde	30-75	VD	Gravelly loam	H-VH	M	Poor: slope	None
		Edmundston	30-75	D	Gravelly sandy loam	H-VH	M	Poor: slope	None
239-241	Edmundston-Tollhouse-Godde Association: Deep and shallow, steep to very steep, well-drained and somewhat excessively drained soils underlain by weathered granite; on mountainous uplands	Edmundston	50-75	D	Gravelly sandy loam	H-VH	M	Poor: slope	None
		Tollhouse	30-50	S	Gravelly sandy loam	H-VH	M	Poor: quantity, slope	None
			30-50	S	Gravelly sandy loam	H-VH	M	Poor: quantity, slope	None
242-243 248-249 253-255	Steuber-Tehachapi-Havala Association: Very deep, nearly level to hilly, well-drained soils on alluvial fans, stream floodplains, and terraces of the mountain valleys	Steuber	2-9	D	Stony sandy loam, sandy loam	L	M	Good to Fair: stones	Some
		Tehachapi	2-30	D	Loam, sandy loam	L-H	L	Good to Fair: slope	Some
		Havala	0-15	VD	Sandy loam	L-M	M	Good: none	Some

APPENDIX A-1 CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE MOJAVE PIPELINE PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)^{a}	Depth Class^{f}	Texture^{b}	Erosion Potential		Reclamation Potential Limitations^{e}	Cropland
						Water^{c}	Wind^{d}		
255-256	Chanac-Pleito-Badlands Association: Very deep, gently sloping to steep, well-drained on old dissected terraces; and badlands	Chanac	5-50	VD	Sandy clay loam, sandy loam	L-VH	L	Good to Poor: slope	None
		Pleito	2-50	VD	Sandy clay loam, gravelly sandy clay loam	L-VH	L	Good to Poor: slope	None
		Badlands	30-75	-	-	-	-	-	
	San Joaquin Valley Area								
256-261.7	Hesperia-Arvin-Whitewolf Association: Very deep, nearly level to moderately sloping, well-drained and somewhat excessively drained soils on alluvial fans, flood plains, and stream terraces	Hesperia	0-9	D-VD	Sandy loam	L-M	M	Good: none	Some
		Arvin	2-9	D	Sandy loam	L-M	M	Good: none	Some
		Whitewolf	0-5	D-VD	Loamy sand	L	H	Poor: sandy texture	Some
261.7-262 271.7-275 320.5-322.6	Panoche clay loam: Deep, well-drained soil developing in alluvium of alluvial fans and plains derived from sedimentary or granitic rock	Panoche	0-2	VD	Clay loam	L	L	Good: none	Some
262.0-262.7	Cajon-Tujunga Association: Deep, somewhat excessively drained coarse textured soils developing in granitic alluvium	Cajon	0-5	D	Loamy sand	L	H	Poor: sandy texture	Some
		Tujunga	2-5	D	Loamy sand	L	M	Poor: sandy texture	Some
262.7-271.7 275.0-308.1 310.5-312.7	San Emigdio-Hesperia Association: Deep to very deep, well drained, coarse textured soils developing in alluvium on fans	San Emigdio	2-5	VD	Fine sandy loam	L	M	Good: none	Some
		Hesperia	2-5	D-VD	Sandy loam	L	M	Good: none	Some
308.1-310.5	Kettleman Association: Moderately deep, well drained, medium textured soils developing in weathered sedimentary rock of hilly to steep mountainous areas	Kettleman	5-50	MD	Loam	L-VH	L	Fair to Poor: quantity, slope	None
312.7-316.0	Elkhills-Torriorthents stratified complex Association: Deep, well-drained soils forming in alluvium on dissected uplands	Elkhills	9-50	VD	Sandy loam	M-VH	M	Good to Poor: slope	None
		Torriorthents	9-50	VD	Very gravelly sandy loam	M-VH	M	Fair to Poor: gravelly texture slope	None
316.0-320.5 322.6-325	Kimberlina Association: Deep to very deep, well-drained soil forming in alluvium on fans and plains	Kimberlina	0-5	D-VD	Sandy loam, gravelly sandy loam	L	L	Good: none	Some
Kern Lateral 0-4.5 6.0-15.5	Hesperia-Arvin-Whitewolf: Association: Very deep, nearly level to moderately sloping, well-drained and somewhat excessively drained soils on alluvial fans, flood plains, and stream terraces	Hesperia	0-9	D-VD	Sandy loam	L-M	M	Good: none	Some
		Arvin	2-9	D	Sandy loam	L-M	M	Good: none	Some
		Whitewolf	0-5	D-VD	Loamy sand	L	H	Poor: sandy texture	Some

APPENDIX A-1 CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE MOJAVE PIPELINE PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
4.5-6.0	Chanac-Pleito-Badlands Association: Very deep, gently sloping to steep, well-drained soils on old dissected terraces; and Badlands	Chanac	5-50	VD	Sandy loam	L-VH	L	Good to Poor: slope	None
		Pleito	2-50	VD	Sandy clay loam, gravelly sandy clay	L-VH	L	Good to Poor: slope	None
		Badlands	-	-	----	-	-	-----	--
15.5-16.3 19.5-21.0	Delano-Adelanto Association: Very deep, well-drained moderately fine textured soils forming in mixed alluvium of alluvial fans	Delano	0-9	VD	Sandy loam, sandy clay loam	L-M	L	Good: none	Some
		Adelanto	0-5	VD	Sandy loam	L	M-H	Good: none	Some
16.3-19.3	Cajon-Tujunga Association: Deep, somewhat excessively drained coarse textured soils developing in granitic alluvium of alluvial stringer and fans	Cajon	0-5	D	Loamy sand	L	H	Poor: sandy texture	Some
		Tujunga	2-5	D	Loamy sand	L	M	Poor: sandy texture	Some
19.3-19.5	Cajon-Calhi Association: Deep, somewhat excessively drained coarse textured soils forming in granitic alluvium of sloping alluvial fans	Cajon	0-5	D	Loamy sand	L	H	Poor: sandy texture	None
		Calhi	0-9	D	Loamy fine sand	L-M	H	Poor: sandy texture	None
21.0-27.5	Delano sandy loam: Very deep, well-drained soil forming in granitic alluvium of alluvial plains and terraces	Delano	0-5	VD	Sandy loam, sandy clay loam	L	L	Good: none	Some
27.5-28.9 29.7-32.0	Xeric Torriorthents, stratified-Cuyama complex: Deep and very deep, gravelly and loamy soils on dissected slopes	Xeric Torriorthents	9-50	D	Gravelly loamy texture	L-VH	L	Fair to Poor: gravelly texture, slope	None
		Cuyama	9-15	VD	Gravelly clay loam	L-M	M	Fair: slope, gravels	None
28.9-29.7	Cuyama loam: Deep, well-drained soil forming in granitic alluvium of dissected alluvial fans and stream terraces	Cuyama	2-15	VD	Loam, gravelly loam	L-M	M	Good to Fair: slope, gravels	None
32-32.5	Excelsior Variant-Cajon-Riverwash Association: Very deep, loamy and sandy soils on bottomlands, terraces and fans	Excelsior Variant	0-3	VD	Stratified sand to silt loam	L	L	Fair: sandy texture	Some
		Cajon	0-3	VD	Loamy sand	L	H	Poor: sandy texture	Some
		Riverwash	0-3	VD	Sand and gravel	-	-	-	
32.5-41 44-45	Elkhills-Torriorthents stratified, complex Association: Deep, well-drained soils forming in alluvium dissected uplands	Elkhills	9-50	VD	Sandy loam, loam	M-VH	L	Good to Poor: slope	--
		Torriorthents	9-50	VD	Very gravelly sandy loam	M-VH	L	Fair to Poor: gravel slope	--

APPENDIX A-1 CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE MOJAVE PIPELINE PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)^a	Depth Class^f	Texture^b	Erosion Potential Water^c	Erosion Potential Wind^d	Reclamation Potential Limitations^e	Cropland
41-44	Hesperia-Hanford Association: Very deep, well-drained moderately coarse textured soils forming in granitic alluvium of alluvial plains along streams and rivers	Hesperia	0-9	D-VD	Sandy loam	L-M	M	Good: none	None
		Hanford	0-15	VD	Find sandy loam	L-M	M	Good to Fair: slope	None
Mojave-Alternative A Basin and Range Phsyiographic Province									
0-8.35 9.4-10.1 12.2-23	Rositas-Gunsight Association: Deep, somewhat excessively drained, sandy and very gravelly soils; on sloping to moderately steep fan terraces	Rositas	5-35	D	Sand	L-H	H	Poor: sandy texture	None
		Gunsight	2-35	D	Very gravelly loam	L-H	L	Fair to Poor: very gravelly and stony	None
8.3-9.4 10.1-12.2	Cipriano very stony loam: Shallow, well-drained, very cobbly and stony soils, on sloping fan terraces	Cipriano	2-10	S	Very stony loam over a hardpan	L-M	L	Poor: quantity, rock fragments	None
Mojave Alternative B Mojave Desert									
0-11 56-76.0	Mojave Desert: Landscapes include stream terraces and floodplains, old and recent alluvial fans, desert pavement on older alluvial fans, basin floor and rims, and playas	Garlock	2-9	VD	Loamy sand to sandy clay loam	L	H	Fair: sandy texture	None
		Cajon	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
		Halloran	0-2	VD	Sand, sandy loam	L	H	Poor: sandy texture, saline/alkaline	
		Manet	0-9	VD	Sand, loamy sand	L	H	Poor: sandy texture	None
		Rosamond	0-2	VD	Loam, clay loam	L	H	Poor: high salinity/alkalinity	None
		Bousic	0-1	VD	Clay	L	M	Poor: high salinity/alkalinity and clayey texture	None
		Unnamed (playas)	0-1	VD	Variable	L	M	Poor: high salinity/alkalinity	None
		Villa	0-2	VD	Loamy sand	L	H	Poor: sandy texture	None
		Victorville	0-2	VD	Sandy loam	L	M	Fair: sandy texture	None
		Unnamed (desert pavement)	0-5	MD-D	Silt loam, clay loam	-	M	Fair: coarse fragments	None
11-12	Playas-Bousic Association: Playas and very deep, nearly level, moderately well-drained soils on basin rims	Playas	0-1	VD	Variable	L	M	Poor: high salinity/alkalinity	None
		Bousic	0-1	VD	Clay	L	M	Poor: high salinity/alkalinity and clayey texture	None
12-13.5 20-22 41-42	Rosamond-Lavic-Cave Association: Very deep and shallow, nearly level and gently sloping, moderately well-drained and well-drained soils on basin rims and low alluvial fans	Rosamond	0-2	VD	Loam, clay loam, loamy sand	L	H	Poor: high salinity/alkalinity	None
		Lavic	0-5	VD	Loamy sand, sandy loam	L	H	Fair: sandy texture, and quantity	None
		Cave	0-2	S	Loam over a hardpan	L	M	Poor: sandy texture and quantity	None

APPENDIX A-1 CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE MOJAVE PIPELINE PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential		Reclamation Potential Limitations[e]	Cropland
						Water[c]	Wind[d]		
13.5-20 46.5-50 50.5-56	Halloran-Cajon, loamy substratum Norob Association: Very deep, nearly level and gently sloping, somewhat excessively drained and moderately well-drained soils on terraces and alluvial fans	Halloran	0-2	VD	Loamy sand, sandy loam	L	H	Poor: saline/alkaline	None
		Cajon, loamy substratum	0-2	VD	Sand, loamy sand, over loam	L	H	Poor: sandy texture	None
		Norob	0-5	VD	Sandy clay loam	L	M	Poor: saline/alkaline	None
22-31 31.5-32 34-36	Cajon-Manet Association: Very nearly level to strongly sloping, somewhat excessively drained and well-drained soils on recent alluvial fans	Cajon	0-15	VD	Sand, loamy sand	L-M	H	Poor: sandy texture	None
		Manet	0-9	VD	Sand, loamy sand	L	H	Poor: sandy texture	None
31-31.5 36-41 42-45	Villa-Riverwash-Victorville Association: Very deep, nearly level, moderately well-drained soils on floodplains and low terraces; also Riverwash	Villa	0-2	VD	Loamy sand, sandy loam	L	H	Poor: sandy texture	None
		Riverwash	0-2	VD	Sand	–	–	–	
		Victorville	0-2	VD	Sandy loam, loamy sand	L	M	Fair: sandy texture	None
32-34 50-50.5	Rock Outcrop-Lithic Torriorthents-Sparkhule Association: Rock outcrop; and very shallow and shallow, moderately steep to steep well-drained soils on desert foothills and mountains	Rock Outcrop	>50	–	--	–	–	–	
		Lithic Torriorthents	15-50	VS-S	Sandy loam, gravelly sand	M-VH	L-M	Poor: quantity	None
		Sparkhule	15-50	S	Gravelly sandy loam, sandy clay loam	M-VH	L	Poor: quantity and slope	None
45-46.5	Bryman-Helendale Association: Very deep, nearly level to strongly sloping, well-drained soils on alluvial fans and terraces	Bryman	0-15	VD	Loamy sand, sandy clay loam	L-M	H	Fair to Good: slope	None
		Helendale	0-5	VD	Loamy sand, sandy loam	L	H	Good: none	None

[a] Slope range for soil series, pipeline may be on gentler portions of slope range.

[b] Typical textures in soil profile

[c] L(low) = <5 tons/acre/year
M(moderate) = 5-20 tons/acre/year
H(high) = 20-50 tons/acre/year
VH(very high) = >50 tons/acre/year

[d] Based on WEG (Wind Erodibility Group): L(Low) = 5-8; M(moderate) = 2-4; H(high) = 1-2; or Soil Conservation Service interpretations based on soil mapping unit descriptions

[e] Based on trenching with no selective soil handling or mitigation.

[f] Soil depth classes:
VS 0-10 inches
S 10-20 inches
MD 20-40 inches
D 40-60 inches
VD 60+ inches

APPENDIX A-2 CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE EL DORADO PIPELINE PROPOSAL

Milepost	Soil Mapping Unit	Soil Series	Slope (%)^a	Depth Class^f	Texture^b	Erosion Potential Water^c	Erosion Potential Wind^d	Reclamation Potential Limitations^e	Cropland
El Dorado North Receipt Lateral Mojave Desert									
0-16.5	Rositas-Gunsight Association: Deep, somewhat excessively drained, sandy and very gravelly soils; on sloping to moderately steep fan terraces.	Rositas	5-35	D	Sand	L-H	H	Poor: sandy texture	None
		Gunsight	2-35	D	Very gravelly loam	L-H	L	Fair to Poor: very gravelly and stony	None
El Dorado Mainline									
0.00-52.8 53.4-67.2 68.8-75.7 77.7-84.6 86.1-122.2 167.9-180.5	Mojave Desert: Landscapes include stream terraces and floodplains, old and recent alluvial fans, desert pavement on older alluvial fans, basin floor and rims, and playas	Garlock	2-9	VD	Loamy sand to sandy clay loam	L	H	Fair: sandy texture	None
		Cajon	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
		Halloran	0-2	VD	Sand, sandy loam	L	H	Poor: sandy texture, saline/ alkaline	
		Manet	0-9	VD	Sand, loamy sand	L	H	Poor: sandy texture	None
		Rosamond	0-2	VD	Loam, clay loam	L	H	Poor: high salinity/alkalinity	None
		Bousic	0-1	VD	Clay	L	M	Poor: high salinity/alkalinity and clayey texture	None
		Unnamed (playas)	0-1	VD	Variable	L	M	Poor: high salinity/alkalinity	None
		Villa	0-2	VD	Loamy sand	L	H	Poor: sandy texture	None
		Victorville	0-2	VD	Sandy loam	L	M	Fair: sandy texture	None
		Unnamed (desert pavement)	0-5	MD-D	Silt loam, clay loam	L	M	Fair: coarse fragments	None
52.8-53.4 67.2-68.8 75.7-77.7 84.6-86.1	Rock Outcrop-Lithic Torriorthents-Sparkhule Association: Rock outcrop; and very shallow and shallow, moderately steep to steep well-drained soils on desert foothills and mountains	Rock Outcrop	>50	-	Rock	-	-	-	
		Lithic Torriorthents	15-50	VS-S	Sandy loam, very gravelly sand	M-VH	L-M	Poor: quantity	None
		Sparkhule	15-50	S	Gravelly sandy loam, sandy clay loam	M-VH	L	Poor: quantity and slope	None
122.2-123.6	Playas-Bousic: Associations: Playas and very deep, nearly level, moderately well-drained soils on basin rims	Playas	0-1	VD	Variable	L	M	Poor: high salinity/alkalinity	None
		Bousic	0-1	VD	Clay	L	M	Poor: high salinity/alkalinity and clayey texture	None
123.6-125.2 131.3-133.6	Rosamond-Lavic-Cave Association: Very deep and shallow, nearly level and gently sloping, moderately well-drained and well drained soils on basin rims and low alluvial fans	Rosamond	0-2	VD	Loam, clay loam, loamy sand	L	M	Poor: high salinity/alkalinity	None
		Lavic	0-5	VD	Loamy sand, sandy loam	L	H	Fair: sandy texture, high lime	None
		Cave	0-2	S	Loam over a hardpan	L	M	Poor: quantity	None

APPENDIX A-2 CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE EL DORADO PIPELINE PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential		Reclamation Potential Limitations[e]	Cropland
						Water[c]	Wind[d]		
125.2-131.3 153.8-155.6 158.2-167.9	Halloran-Cajon, loamy substratum Norob Association: Very deep, nearly level and gently sloping, somewhat excessively drained and moderately well-drained soils on terraces and alluvial fans	Halloran	0-2	VD	Loamy sand, sandy loam	L	H	Poor: saline/alkaline	None
		Cajon, loamy substratum	0-2	VD	Sand, loamy sand, over loamy	L	H	Poor: sandy texture	None
		Norob	0-5	VD	Sandy clay loam	L	M	Poor: saline/alkaline	None
145.2-146.3 147.0-149.1	Nebora-Cuddeback Association: Shallow and moderately deep, gently sloping to moderately sloping, well drained soils with desert pavement on old terraces and alluvial fans	Nebona	2-9	S	Sandy loam over a hardpan	L	M	Poor: quantity	None
		Cuddeback	2-9	MD	Gravelly sandy clay loam over a hardpan	L	M	Fair: quantity	None
146.3-147.0 149.1-150.7 151.8-153.8 133.6-145.2	Cajon-Manet Association: Very deep, nearly to strongly sloping, somewhat excessively drained and well-drained soils on recent alluvial fans	Cajon	0-15	VD	Sand, loamy sand	L	H	Poor: sandy texture	None
		Manet	0-9	VD	Sand, loamy sand	L	H	Poor: sandy texture	None
150.7-151.8	Mirage-Joshua Association: Very deep and moderately deep, gently sloping to strongly sloping, well drained soils with desert pavement on old terraces	Mirage	2-5	VD	Sandy clay loam over gravelly loamy sand	L	M	Fair: gravelly substratum	None
		Joshua	2-15	MD	Gravelly sandy loam over cemented very gravelly loamy sand	L	M	Fair: gravelly substratum, quantity	None
155.6-158.2	Villa-Riverwash-Victorville Association: Very deep, nearly level, moderately well-drained soils on floodplains and low terraces; also Riverwash	Villa	0-2	VD	Loamy sand, sandy loam	L	H	Poor: sandy texture	None
		Riverwash	0-2	VD	Sand	–	–	–	
		Victorville	0-2	VD	Sandy loam, loamy sand	L	M	Fair: sandy texture	None
180.5-186.6 193.6-198.4	Cajon-Arizo-Alko Association: Very deep and shallow, nearly level to strongly sloping, well-drained and excessively drained soils on alluvial fans, alluvial plains, and old terraces	Cajon	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
		Arizo	2-9	VD	Gravelly loamy sand	L	H	Poor: gravelly texture; sandy texture	None
		Alko	0-9	S	Sandy loam over a hardpan	L	M	Poor: quantity	None
186.6-193.6 198.4-200.0	Norob-Neuralia Association: Very deep and deep, nearly level and gently sloping, well-drained soils on alluvial fans and plains	Norob	0-5	VD	Sandy clay loam	L	M	Poor: saline/alkaline	None
		Neuralia	2-5	D	Sandy loam, sandy clay loam	L	M	Good: none	None

APPENDIX A-2 CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE EL DORADO PIPELINE PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
200.0-202.0 208.6-216.1 220.9-223.3	Garlock-Nerualia Association: Very deep and deep, nearly level to moderately sloping, well-drained soils on old stream terraces, alluvial fans and alluvial plains	Garlock	2-9	VD	Loamy sand to sandy clay loam	L	H	Fair: sandy texture	None
		Neuralia	2-5	VD	Sandy loam, sandy clay loam	L	M	Good: None	None
202.0-207.6	Randsburg-Muroc Association: Shallow, gently sloping to strongly sloping, well-drained soils on low pediments	Randsburg	2-15	S	Sandy loam	L-M	M	Poor: quantity	None
		Muroc	2-9	S	Sandy loam over a hardpan	L	M	Poor: quantity	None
207.6-208.6 218.6-220.9	Cajon: Very deep, nearly level to strongly sloping, somewhat excessively drained soils on alluvial fans and plains	Cajon	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
216.1-218.6	Rosamond-DeStazo Association: Very deep, nearly level to moderately sloping, well-drained soils; on flood plains and in basins	Rosamond	5-15	VD	Clay loam, loam	L-M	M	Good to Poor: sometimes saline/alkaline	None
		DeStazo	0-2	VD	Very gravelly sandy loam to clay loam	L	M	Fair to Poor: gravels, high lime	None
Tehachapi Mountains Area									
223.3-230.0	Pajuela-Whitewolf Association: Very deep, nearly level to steep, somewhat excessively drained soils on old stream terraces, alluvial fans, and flood plains	Pajuela	30-50	D	Very gravelly loamy sand	H-VH	M	Poor: gravelly texture, slope	None
		Whitewolf	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
230.0-231.2	Rock Outcrop-Jawbone-Xeric Torriorthents Association: Rock outcrop and shallow, hilly to very steep, well-drained and somewhat excessively drained soils on mountainous uplands	Rock outcrop	50-75	-	Rock	-	-	-	
		Jawbone	15-75	VS	Gravelly loamy sand	M-VH	H	Poor: quantity, slope	None
		Xeric Torriorthents	50-85	S	Gravelly loamy texture	H-VH	M	Poor: quantity, slope	None
231.2-237.2 237.9-240.0 239.6-244.7	Steuber-Tehachapi-Havala Association: Very deep, nearly level to hilly, well-drained soils on alluvial fans, stream floodplains, and terraces of the mountain valleys	Steuber	2-9	D	Stony sandy loam, sandy loam	L	M	Good to Fair: stones	Some
		Tehachapi	2-30	D	Loam, sandy loam	L-H	L	Good to Fair: slope	Some
		Havala	0-15	VD	Sandy loam	L-M	M	Good: none	Some

APPENDIX A-2 CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE EL DORADO PIPELINE PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
237.2-237.9 240.0-239.6 244.7-253.4	Walong-Anaverde-Edmundston Association: Very deep to moderately deep, hilly to very steep, well-drained soils underlain by weathered granite or schist; on mountainous uplands	Walong	15-30	MD	Sandy loam	M-H	M	Fair to Poor: slope, quantity	None
		Anaverde	30-75	VD	Gravelly loam	H-VH	M	Poor: slope	None
		Edmundston	30-75	D	Gravelly sandy loam	H-VH	M	Poor: slope	None
253.4-254.6	Chanac-Pleito-Badlands Association: Very deep, gently sloping to steep, well-drained on old dissected terraces; and badlands	Chanac	5-50	VD	Sandy clay loam, sandy loam	L-VH	L	Good to Poor: slope	None
		Pleito	2-50	VD	Sandy clay loam, gravelly sandy clay loam	L-VH	L	Good to Poor: slope	None
		Badlands	30-75	-	-	-	-	-	
	San Joaquin Valley Area								
254.6-261.4	Hesperia-Arvin-Whitewolf Association: Very deep, nearly level to moderately sloping, well-drained and somewhat excessively drained soils on alluvial fans, flood plains, and stream terraces	Hesperia	0-9	D-VD	Sandy loam	L-M	M	Good: none	Some
		Arvin	2-9	D	Sandy loam	L-M	M	Good: none	Some
		Whitewolf	0-5	D-VD	Loamy sand	L	H	Poor: sandy texture	Some
261.4-302.5 304.2-305.6	San Emigdio-Hesperia Association: Deep to very deep, well drained, coarse textured soils developing in alluvium on fans	San Emigdio	2-5	VD	Fine sandy loam	L	M	Good: none	Some
		Hesperia	2-5	D-VD	Sandy loam	L	M	Good: none	Some
302.5-304.2	Kettleman Association: Moderately deep, well drained, medium textured soils developing in weathered sedimentary rock of hilly to steep mountainous areas	Kettleman	5-50	MD	Loam	L-VH	L	Fair to Poor: quantity, slope	None
305.6-310.7	Elkhills-Torriorthents stratified complex Association: Deep, well-drained soils forming in alluvium on dissected uplands	Elkhills	9-50	VD	Sandy loam	M-VH	M	Good to Poor: slope	None
		Torriorthents	9-50	VD	Very gravelly sandy loam	M-VH	M	Fair to Poor: gravelly texture slope	None
310.7-324.3	Kimberlina Association: Deep to very deep, well-drained soil forming in alluvium on fans and plains	Kimberlina	0-5	D-VD	Sandy loam, gravelly sandy loam	L	L	Good: none	Some

APPENDIX A-2 CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE EL DORADO PIPELINE PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
East Delivery Lateral									
0.0-8.5 32.4-32.9	Hesperia-Hanford Association: Very deep, well-drained moderately coarse textured soils forming in granitic alluvium of alluvial plains along streams and rivers	Hesperia	0-9	D-VD	Sandy loam	L-M	M	Good: none	None
		Hanford	0-15	VD	Find sandy loam	L-M	M	Good to Fair: slope	None
8.5-12.8	Delano-Adelanto Association: Very deep, well-drained moderately fine textured soils forming in mixed alluvium of alluvial fans	Delano	0-9	VD	Sandy loam, sandy clay loam	L-M	L	Good: none	Some
		Adelanto	0-5	VD	Sandy loam	L	M-H	Good: none	Some
12.8-14.4	Delano sandy loam: Very deep, well-drained soil forming in granitic alluvium of alluvial plains and terraces	Delano	0-5	VD	Sandy loam, sandy clay loam	L	L	Good: none	Some
14.4-15.4	Cajon-Tujunga Association: Deep, somewhat excessively drained coarse textured soils developing in granitic alluvium of alluvial stringer and fans	Cajon	0-5	D	Loamy sand	L	H	Poor: sandy texture	Some
		Tujunga	2-5	D	Loamy sand	L	M	Poor: sandy texture	Some
15.4-21.4 23.5-25.0	Delano-Cuyama Association: very deep, nearly level to sloping, well drained soils; on fans and terraces.	Delano	0-9	VD	Clay loam	L-M	L	Good: none	None
		Cuyama	0-9	VD	Gravelly clay loam	L-M	L	Good to Fair: gravels	None
21.4-23.5	Excelsior Variant-Cajon-Riverwash Association: very deep, loamy and sandy soils on bottomlands, terraces and fans.	Excelsior Variant	0-3	VD	Stratified sand to silt loam	L	L	Fair: sandy texture	Some
		Cajon	0-3	VD	Loamy sand	L	H	Poor: sandy texture	Some
		Riverwash	0-3	VD	Sand and gravel	-	-	---	--
25.0-32.4 32.9-35.8	Kettleman Association: Moderately deep, well drained, medium textured soils developing in weathered sedimentary rock of hilly to steep mountainous areas	Kettleman	5-50	MD	Loam	L-VH	L	Fair to Poor: quantity, slope	None

APPENDIX A-2 CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE EL DORADO PIPELINE PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
Alternative A									
Mojave Desert									
0.00-75.4	Mojave Desert: Landscapes include stream terraces and floodplains, old and recent alluvial fans, desert pavement on older alluvial fans, basin floor and rims, and playas	Garlock	2-9	VD	Loamy sand to sandy clay loam	L	H	Fair: sandy texture	None
		Cajon	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
		Halloran	0-2	VD	Sand, sandy loam	L	H	Poor: sandy texture, saline/ alkaline	
		Manet	0-9	VD	Sand, loamy sand	L	H	Poor: sandy texture	None
		Rosamond	0-2	VD	Loam, clay loam	L	H	Poor: high salinity/alkalinity	None
		Bousic	0-1	VD	Clay	L	M	Poor: high salinity/alkalinity and clayey texture	None
		Unnamed (playas)	0-1	VD	Variable	L	M	Poor: high salinity/alkalinity	None
		Villa	0-2	VD	Loamy sand	L	H	Poor: sandy texture	None
		Victorville	0-2	VD	Sandy loam	L	M	Fair: sandy texture	None
		Unnamed (desert pavement)	0-5	MD-D	Silt loam, clay loam	-	M	Fair: coarse fragments	None
Alternative B									
0-1.5 2-6.5	Steuber-Tehachapi-Havala Association: Very deep, nearly level to hilly, well-drained soils on alluvial fans, stream floodplains, and terraces of the mountain valleys	Steuber	2-9	D	Stony sandy loam, sandy loam	L	M	Good to Fair: stones	Some
		Tehachapi	2-30	D	Loam, sandy loam	L-H	L	Good to Fair: slope	Some
		Havala	0-15	VD	Sandy loam	L-M	M	Good: none	Some
1.5-2 6.5-8.3	Walong-Anaverde-Edmundston Association: Very deep to moderately deep, hilly to very steep, well-drained soils underlain by weathered granite or schist; on mountainous uplands	Walong	15-30	MD	Sandy loam	M-H	M	Fair: slope, quantity	None
		Anaverde	30-75	VD	Gravelly loam	H-VH	M	Poor: slope	None
		Edmundston	30-75	D	Gravelly sandy loam	H-VH	M	Poor: slope	None

APPENDIX A-2 CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE EL DORADO PIPELINE PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential		Reclamation Potential Limitations[e]	Cropland
						Water[c]	Wind[d]		
Alternative C									
	Tehachapi Mountains								
0-3	Walong-Anaverde-Edmundston Association: Very deep to moderately deep, hilly to very steep, well-drained soils underlain by weathered granite or schist; on mountainous uplands	Walong	15-30	MD	Sandy loam	M-H	M	Fair: slope, quantity	None
		Anaverde	30-75	VD	Gravelly loam	H-VH	M	Poor: slope	None
		Edmundston	30-75	D	Gravelly sandy loam	H-VH	M	Poor: slope	None
3-5.0	Chanac-Pleito-Badlands Association: Very deep, gently sloping to steep, well-drained soils on old dissected terraces; and badlands	Chanac	5-50	VD	Sandy clay loam, sandy loam	L-VH	L	Good to Poor: slope	None
		Pleito	2-50	VD	Sandy clay loam, gravelly sandy clay loam	L-VH	L	Good to Poor: slope	None
		Badlands	30-75	-	-	-	-	-	
5.0-5.6	Hesperia-Arvin-Whitewolf Association: Very deep, nearly level to moderately sloping, well-drained and somewhat excessively drained soils on alluvial fans, floodplains, and stream terraces	Hesperia	0-9	D-VD	Sandy loam	L	M	Good: none	None
		Arvin	2-9	D	Sandy loam	L	M	Good: none	None
		Whitewolf	0-5	D-VD	Loamy sand	L	H	Poor: sandy texture	None

[a] Slope range for soil series, pipeline may be on gentler portions of slope range.

[b] Typical textures in soil profile

[c] L(low) = <5 tons/acre/year
M(moderate) = 5-20 tons/acre/year
H(high) = 20-50 tons/acre/year
VH(very high) = >50 tons/acre/year

[d] Based on WEG (Wind Erodibility Group): L(Low) = 5-8; M(moderate) = 2-4; H(high) = 1-2; or Soil Conservation Service interpretations based on soil mapping unit descriptions

[e] Based on trenching with no selective soil handling or mitigation.

[f] Soil depth classes:

VS	0-10 inches
S	10-20 inches
MD	20-40 inches
D	40-60 inches
VD	60+ inches

Appendix A-3a. CHARACTERISTICS OF SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE EL PASO BASE CASE.

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential: Limitations[e]	Cropland
Colorado Plateau									
Window Rock A Loop									
118.7-124.5	Palma-Clovis-Trail Association: Deep, coarse to moderately fine-textured, nearly level to rolling soils on plains	Palma	1-15	VD	Sandy loam	L-M	M	Good: none	None
		Clovis	1-15	VD	Sandy clay loam	L-M	M	Good: none	None
		Trail	0-5	VD	Loamy fine sand	L	H	Poor: sandy texture	None
Navajo A Loop									
156.5-165.5	Rudd-Bandera-Cabezon Association: Shallow, gravelly, cobbly and stony, medium and fine-textured, undulating soils on plains and mesa tops and gently rolling to steep soils on cinder cones	Rudd	2-9	S	Very cobbly loam	L	L	Poor: quantity & coarse fragments	None
		Bandera	2-50	S	Gravelly loam over cinders	L-VH	L	Poor: quantity and gravels	None
		Cabezon	2-50	S	Cobbly loam over cobbly clay over bedrock	L-VH	L	Poor: quantity, slope and coarse fragments	None

[a] Slope range for soil series, pipeline may be on gentler portions of slope range.

[b] Typical textures in soil profile.

[c] L (low) = <5 tons/acre/year
M (moderate) = 5-20 tons/acre/year
H (high) = 20-50 tons/acre/year
VH (very high) = >50 tons/acre/year

[d] Based on WEG (Wind Erodibility Classes): L (low) = 5-8; M (moderate) = 2-4; H (high) = 1-2; or Soil Conservation Service interpretations based on soil mapping unit descriptions.

[e] Based on trenching with no selective soil handling.

[f] Soil depth classes:
VS 0-10 inches
S 10-20 inches
MD 20-40 inches
D 40-60 inches
VD 60+ inches

Appendix A-3b. CHARACTERISTICS OF SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE EL PASO 600 MMcfd ALTERNATIVES

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential: Limitations[e]	Cropland
Colorado Plateau									
Blanco Loop									
14.6-4	Farb-Persayo-Fruitland Association: Shallow to very deep, well and excessively drained, loamy soils; on sloping to steep hills, breaks, and valleys	Farb	3-30	VS	Fine sandy loam	L-H	M	Poor: quantity	None
		Persayo	3-30	S	Silty clay loam	L-H	M	Poor: quantity	None
		Fruitland	0-8	VD	Sandy loam	L	M	Good: none	None
4-0	Gypsiorthids-Badland-Stumble Complex: shallow to very deep, well and excessively drained, gypsiferous and sandy soils, and badlands; on sloping to steep hills, knolls, and breaks	Gypsiorthids	5-30	S-D	Sandy loam over gypsum	L-H	H	Poor: gypsum	None
		Badland	5-30	-	----	-	-	----	--
		Stumble	5-8	VD	Loamy sand	L	H	Poor: sandy texture	None
Window Rock B Loop									
85.3-93 94-94.5	Penistaja-Lohmiller-Travesilla Association: Deep and shallow, well drained, loamy and clayey soils; on sloping to moderately steep valleys and side slopes	Penistaja	0-5	D	Fine sandy loam, sandy clay loam	L	M	Good: none	None
		Lohmiller	0-3	D	Clay loam, clay	L	L	Fair to Poor: clayey texture	None
		Travesilla	1-25	S	Fine sandy loam	L-H	M	Poor: quantity	None
93-94 94.5-98.5	Rock Land-Travesilla Association: soils occur on rough, broken topography with considerable variation in local relief and formed in regolith and colluvium of sandstone and shale	Rockland	-	-	----	-	-	----	--
		Travesilla	1-25	S	Fine sandy loam	L-H	M	Poor: quantity	None
98.5-101.5	Fruitland-Camborthids-Torrifluvents Association: shallow to deep, moderately coarse to moderately fine texture, nearly level to hilly soils on upland plains and valleys	Fruitland	1-8	VD	Sandy loam	L	M	Good: none	None
		Camborthids	2-9	S-VD	Sandy loam	L	M	Good to Poor: quantity	None
		Torrifluvents	0-3	VD	Sandy loam to clay loam	L	M	Good: none	None

Appendix A-3b. CHARACTERISTICS OF SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE EL PASO 600 MMcfd ALTERNATIVES (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential: Limitations[e]	Cropland
101.5-117	Cryorthents-Eutroboralfs Association: shallow to deep, moderately coarse to fine textured, gently sloping to steep high mountain and plateau soils	Cryorthents	2-50	S-MD	Gravelly loam to clay loam	L-VH	M	Fair to Poor: quantity, slope	None
		Eutroboralfs	2-9	MD-D	Sandy loam to clay	L-M	M	Good to Fair: clayey texture, quantity	None
Window Rock A Loop									
118.7-124.5	Palma-Clovis-Trail Association: Deep, coarse to moderately fine-textured, nearly level to rolling soils on plains	Palma	1-15	VD	Sandy loam	L-M	M	Good: none	None
		Clovis	1-15	VD	Sandy clay loam	L-M	H	Good: none	None
		Trail	0-5	VD	Loamy fine sand	L	H	Poor: sandy texture	None
Navajo B Loop									
152.4-154	Palma-Clovis-Trail Association: Deep, coarse to moderately fine-textured, nearly level to rolling soils on plains	Palma	1-15	VD	Sandy loam	L-M	M	Good: none	None
		Clovis	1-15	VD	Sandy clay loam	L-M	H	Good: none	None
		Trail	0-5	VD	Loamy fine sand	L	H	Poor: sandy texture	None
154-175	Rudd-Bandera-Cabezon Association: Shallow, gravelly, cobbly and stony, medium and fine-textured, undulating soils on plains and mesa tops and gently rolling to steep soils on cinder cones	Rudd	2-9	S	Very cobbly loam	L	L	Poor: quantity & coarse fragments	None
		Bandera	2-50	S	Gravelly loam over cinders	L-VH	L	Poor: quantity and gravels	None
		Cabezon	2-50	S	Cobbly loam over cobbly clay over bedrock	L-VH	L	Poor: quantity, slope and coarse fragments	None
175-193.1	Fruitland-Camborthids-Torrifluvents Association: shallow to deep, moderately coarse to moderately fine texture, nearly level to hilly soils on upland plains and valleys	Fruitland	2-30	VD	Sandy loam	L-H	M	Good to Fair: sandy texture	None
		Camborthids	2-9	S-VD	Sandy loam	L	M	Good to Poor: quantity	None
		Torrifluvents	0-3	VD	Sandy loam to clay loam	L	M	Good to Fair	None
Navajo A Loop									
156.5-165.5	Rudd-Bandera-Cabezon Association: Shallow, gravelly, cobbly and stony, medium and fine-textured, undulating soils on plains and mesa tops and gently rolling to steep soils on cinder cones	Rudd	2-9	S	Very cobbly loam	L	L	Poor: quantity & coarse fragments	None
		Bandera	2-50	S	Gravelly loam over cinders	L-VH	L	Poor: quantity & gravels	None
		Cabezon	2-50	S	Cobbly loam over cobbly clay over bedrock	L-VH	L	Poor: quantity, slope and coarse fragments	None

Appendix A-3b. CHARACTERISTICS OF SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE EL PASO 600 MMcfd ALTERNATIVES (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential: Limitations[e]	Cropland
Luepp Loop									
229.6-232	Tuweep-Wukoki-Wupatki Association: very shallow to deep, well drained, nearly level to moderately steep soils; on plateaus, mesas, hillsides, and fan terracesloam over cinders	Tuweep	0-15	D	Clay loam over very stony loam	L-M	L	Fair: stones	None
		Wukoki	0-15	S	Very cindery loam	L	L	Poor: quantity	None
		Wupatki	0-15	VS	Very cindery	L	L	Poor: quantity	None
232-247	Vitrandepts-Ustochrepts-Haplustalfs: moderately deep and deep, well drained, very cindery and clayey soils, on nearly level to rolling plateaus	loamy-skeletal families	0-15	MD-D	Very cindery loam	L-M	L	Fair to Poor: cinders	None
		fine families	0-15	MD-D	Cindery clay loam, clay	L-M	L	Fair to Poor: cinders, clayey	None
247-250.3	Eutroboralfs: moderately deep and deep, well drained, very gravelly and loamy soils; on gentle sloping to sloping plateaus and alluvial fans	loamy-skeletal families	0-15	MD-D	Very gravelly loam or clay loam	L-M	L	Fair: rock fragments	None
		fine-loamy families	0-15	MD-D	Loam or clay loam	L-M	L-M	Good to Fair: quantity	None
Williams A Loop									
263.6-276.9	Eutroboralfs-Argiborolls rolling: moderately deep and deep, well drained, clayey and very gravelly soils; on nearly level to rolling plateaus	Fine families	0-15	MD-D	Clay loam, clay	L-M	L-M	Fair to Poor: clayey texture	None
		Clayey-skeletal families	0-15	MD-D	Very gravelly clay loam or clay	L-M	L	Fair to Poor: clayey texture, rock fragments	None
Williams B Loop									
283.4-289	Eutroboralfs-Argiborolls: moderately deep and deep, well drained, clayey and very gravelly soils; on nearly level to rolling plateaus	fine families	0-15	MD-D	Clay loam, clay	L-M	L-M	Fair to Poor: clayey texture	None
		clayey-skeletal families	0-15	MD-D	Very gravelly clay loam or clay	L-M	L	Fair to Poor: clayey texture, rock fragments	None
289.299.8	Cabezon-Springerville-Thunderbird Association: shallow, moderately deep and deep gravelly, cobbly, or stoney fine textured soils on plains, mesas, and sideslopes	Cabezon	8-30	VS-S	Cobbly clay or clay loam	L-H	L	Poor: quantity and rock fragments	None
		Springerville	0-5	MD-D	Cobbly clay	L	L	Poor: clayey texture and rock fragments	None
		Thunderbird	2-15	MD	Cobbly clay loam or clay	L-M	L	Fair to Poor: quantity, clayey	None

Appendix A-3b. CHARACTERISTICS OF SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE EL PASO 600 MMcfd ALTERNATIVES (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)^a	Depth Class^f	Texture^b	Erosion Potential		Reclamation Potential: Limitations^e	Cropland
						Water^c	Wind^d		
Seligman Loop									
317.6-330.5 344.5-345.5	Springerville-Cabezon Association: shallow, moderately deep, gravelly, cobbly, or stony fine textured soils on plains, mesas, and side slopes	Springerville	3-8	MD-D	Cobbly clay	L-M	L	Poor: clayey texture and rock fragments	None
		Cabezon	8-30	VS-S	Cobbly clay or clay loam	L-H	L	Poor: quantity and rock fragments	None
330.5-334 337.5-338.5 340-344.5 345.5-347.6	Pastura-Poley-Partri Association: deep to shallow soils on nearly level to moderately steep fans, plains, and sideslopes	Pastura	0-8	VS-S	Loam, gravelly loam	L-M	L	Poor: quantity and gravelly texture	None
		Poley	0-8	D	Sandy clay loam, clay	L-M	L	Fair: clayey texture	None
		Partri	0-3	D	Gravelly clay loam, clay	L	L	Fair: clayey texture and gravels	None
334-337.5 338.5-340	Tortugas-Purner-Jacks Association: very shallow, shallow and moderately deep; gravelly, cobbly or stoney soils	Tortugas	5-45	VS-S	Very cobbly loam	L-H	L	Poor: coarse fragments, quantity	None
		Purner	2-10	VS-S	Gravelly loam	L	L	Poor: quantity, gravels	None
		Jacks	5-30	MD-D	Gravelly loam, clay	L-M	L	Fair: gravelly and clayey texture	None
Mojave Desert									
Hackberry Loop									
415.9-441.9	Soils of Sacramento and Mojave Valleys: shallow to deep soils on alluvial fans and terraces	Cave	2-8	VS-S	Gravelly sandy loam	L-M	M	Poor: quantity	None
		Anthony	0-5	VD	Sandy loam or gravelly sandy loam	L	M	Good: none	None
		Vinton	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
		Agua	0-2	VD	Loam	L	M	Good: none	None
		Laveen	0-5	VD	Loam	L	L	Good: none	None
		Carrizo	0-8	VD	Very gravelly loamy fine sand	L	H	Poor: gravels, sandy texture	None
		Antho	0-5	VD	Gravelly sandy loam or sandy loam	L	M	Good: none	None

Appendix A-3b. CHARACTERISTICS OF SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE EL PASO 600 MMcfd ALTERNATIVES (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)^a	Depth Class^f	Texture^b	Erosion Potential		Reclamation Potential: Limitations^e	Cropland
						Water^c	Wind^d		
Colorado Plateau									
Laguna Loop (100/500 only)									
330.1-332 333.8-334.5 337.5-337.8	Penistaja-Prewitt-Moriarity Association: Nearly level to strongly sloping and undulating landscapes surfaces with soils forming in mixed alluvial sediments	Penistaja	0-5	D	Fine sandy loam	L	M	Fair: sandy texture	None
		Prewitt	0-5	D	Loam	L	M	Good: none	None
		Moriarity	0-5	D	Clay	L	L	Poor: clayey texture	None
Chaco Loop (200/400 only)									
12.8-15.3	Sheppard-Mayqueen-Shiprock Complex: very deep, somewhat and well drained, sandy and loamy soils on nearly level to sloping mesas and plateaus	Sheppard	5-8	VD	Loamy fine sand	L	H	Poor: sandy texture	None
		Mayqueen	2-8	VD	Sandy loam, loamy fine sand	L	M	Fair to Poor: sandy texture	None
		Shiprock	0-5	VD	Fine sandy loam	L	M	Good: none	None
15.3-16.1	Turley-Slickspots-Riverwash Association: very deep, well drained, loamy soils; on nearly level to gently sloping fans and badlands	Turley	0-3	VD	Clay loam	L	M	Good to Fair: saline/alkaline	None
		Slickspots	0-3	-	----	-	-	Poor: saline/alkaline	None
		Riverwash	0-3	VD	----	-	-	----	--
16.1-16.3	Badland: dissected shale on breaks	Badland	5-50	-	----	-	-	----	--
16.3-19.3	Mesas and Plateaus: Very deep, somewhat excessively and well drained, sandy and loamy soils; on nearly level to sloping mesas and plateaus	Sheppard	5-8	VD	Loamy fine sand	L	H	Poor: sandy texture	None
		Mayqueen	2-8	VD	Sandy loam, loamy fine sand	L	H	Fair to Poor: sandy texture	None
		Shiprock	0-5	VD	Fine sandy loam	L	M	Good: none	None
		Doak	0-3	VD	Sandy clay loam, loam	L	M	Good: none	None
		Uffens	0-3	VD	Clay loam, sandy	L	M	Poor: saline/alkaline	None
White Rock Loop									
43.6-44.1	Alluvial Soils: very deep alluvial soils on bottomlands	Alluvial soils	0-3	VD	Fine texture	L	L	Fair: saline/alkaline	None
44.1-49.0	Badland-Rock Land-Sheppard-Shiprock Association: dominantly Badland and Rockland; and very deep, well drained, sandy and loamy soils; on eroded uplands	Badland, Rock Land	12-55	-	----	-	-	----	--
		Sheppard	0-40	VD	Loam fine sand	L-H	H	Poor: sandy texture	None
		Shiprock	0-8	VD	Fine sandy loam	L	M	Good: none	None

Appendix A-3b. CHARACTERISTICS OF SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE EL PASO 600 MMcfd ALTERNATIVES (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential: Limitations[e]	Cropland
Gallup Loop									
65.1-70.3	Lohmiller-San Mateo-Hageman Travesilla Association: very deep to shallow, well drained, loamy and clayey soils; on nearly level to gently sloping alluvial deposits, and sloping to moderately steep hills and ridges	Lohmiller	0-3	D	Clay loam, clay	L	L	Fair to Poor: clayey texture	None
		San Mateo	0-3	D	Loam	L	M	Good: none	None
		Hageman	1-5	MD-D	Sandy clay loam	L	M	Fair to Good: quantity	None
		Travesilla	0-25	S	Sandy loam	L-M	M	Poor: quantity	None

[a] Slope range for soil series, pipeline may be on gentler portions of slope range.

[b] Typical textures in soil profile.

[c] L (low) = <5 tons/acre/year
M (moderate) = 5-20 tons/acre/year
H (high) = 20-50 tons/acre/year
VH (very high) = >50 tons/acre/year

[d] Based on WEG (Wind Erodibility Classes): L (low) = 5-8; M (moderate) = 2-4; H (high) = 1-2; or Soil Conservation Service interpretations based on soil mapping unit descriptions.

[e] Based on trenching with no selective soil handling.

[f] Soil depth classes:
VS 0-10 inches
S 10-20 inches
MD 20-40 inches
D 40-60 inches
VD 60+ inches

APPENDIX A-3c CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE NORTHWEST EXPANSION PROJECT

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
WYOMING BASIN Muddy Creek Loop									
437.3-415.9	Typic Torriorthents-Typic Caliciorthids-Typic Torripsamments-Rock Outcrop: Undulating to very steep, well drained and excessively drained, deep. Medium deep and shallow sand dune soils and sandy and loamy soils formed in shales and sandstones of the Green River	N/A	0-30	S-D	Sands to clay texture	L-H	M-H	Poor to Fair: quantity saline/alkaline	None
415.9-413.1 412.8-411.9 411.9-411.3 411.0-410.4 410.2-410.1 409.6-408.8 408.4-408.3 407.9-405.8 405.1-404.7 404.4-402.8	Kandaly-Horsley-Westvaco Complex: very shallow to very deep, well drained, sands to clay loam soils; on stable vegetated sand dunes and strongly alkaline soils on undulating plains	Kandaly	3-20	VD	Sands	L-M	H	Poor: wind erosion and droughty	None
		Horsley	2-6	VS	Silty clay loam	L-M	M	Poor: quantity, saline/alkaline	None
		Westvaco	2-6	MD	Sandy clay loam	L-M	M	Poor: saline/alkaline	None
413.1-412.8 410.1-409.9 405.4-405.1	Horsley-Youjay-Rock Outcrop Complex: very shallow to shallow, well drained, sandy clay loam to sandy loam soils; on rolling to steep erosional uplands associated with badland areas	Horsley	6-40	VS	Sandy clay loam	M-H	M	Poor: quantity, saline/alkaline	None
		Youjay	6-40	S	Clay loam	M-H	M	Poor: quantity, saline/alkaline	None
		Rock outcrop	6-40	VS	Massive rock	L	L	Poor: quantity	None
411.9-411.7 404.7-404.3	Monte saline-Kandaly Complex: deep, well drained to excessively drained, clay loam to fine sand soils; on gently sloping alluvial fans and bottomlands with scattered sand dunes	Monte saline	0-3	D	Clay loam	L	M	Fair: saline/alkaline	None
		Kandaly	1-3	D	Fine sand	L	H	Poor: droughty	None
411.3-411.0	Monte Loam: very deep, well drained, loam soils; on elongated drainage ways and somewhat rounded basins	Monte loam	0-3	VD	Loam	L	M	Good	None
410.4-410.2 408.0-407.9	Badlands: moderately steep to very steep barren shale bedrock	Badlands	20-40	VS	Massive rock	M-H	L	Poor: quantity	None

APPENDIX A-3c CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE NORTHWEST EXPANSION PROJECT (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
409.9-409.6	Gasson-Rock Outcrop-Huguston Complex: very shallow to deep, well drained gravelly sandy loam to fine sandy loam soils; on rough, broken side slopes	Gasson	3-30	D	Gravelly sandy loam, very gravelly sand	L-M	L	Fair to Poor: gravels, sandy texture	None
		Rock outcrop	6-40	VS	Massive rock	L	L	Poor: quantity	None
		Huguston	6-30	S	Fine sandy loam	M-H	M	Poor: quantity	None
408.8-408.4	Pepal: very deep, well drained, fine sandy loam soils; on nearly level to gently sloping alluvial fans and terraces	Pepal	0-6	VD	Fine sandy loam	L	M	Good	None
408.3-408.1	Laney: very deep, well drained, sandy loam and clay loam soils; on gently sloping draws and alluvial fans	Laney	0-5	VD	Sandy and clay loam	L	M	Poor: saline/alkaline	None
408.1-408.0	Youjay-Westvaco-Horsley Complex: very shallow to moderately deep, well drained to somewhat excessively well drained, sandy clay loam to sandy loam soils; on nearly level to undulating residual upland plains	Youjay	6-40	S	Clay loam	M-H	M	Poor: quantity, saline/alkaline	None
		Westvaco	2-6	MD	Sandy clay loam	L	M	Poor: saline/alkaline	None
		Horsley	2-6	VS	Sandy clay loam	L	M	Poor; quantity	None
405.8-405.5	Cambarge-Pepal Complex: deep, well drained, gravelly sandy loam soils; on nearly level and gently sloping river terraces	Cambarge	0-6	D	Gravelly sandy loam, very gravelly sand	L	M	Fair to Poor: gravels, sandy sandy texture	None
		Pepal	0-6	D	Gravelly sandy loam	L	M	Good	None
405.5-405.4	Horsley-Huguston-Rock Outcrop Complex: very shallow to shallow moderately well drained to well drained, fine sandy loam to loam and rock outcrop; on hilly residual uplands	Horsley	8-30	VS	Loam	M-H	M	Poor: quantity	None
		Huguston	8-30	S	Fine sandy loam	M-H	M	Poor: quantity	None
		Rock outcrop	8-30	VS	Massive rock	L	L	Poor: quantity	None
Green River Loop									
391.7-391.2 390.6-390.3 389.9-389.1	Kandaly-Horsley-Westvaco Complex: very shallow to very deep, well drained, sands to clay loam soils; on stable vegetated sand dunes and strongly alkaline soils on undulating plains	Kandaly	3-20	VD	Sands	L	H	Poor: wind erosion and droughty	None
		Horsley	2-6	VS	Silty clay loam	L-M	M	Poor: quantity, saline/alkaline	None
		Westvaco	2-6	MD	Sandy loam	L-M	M	Poor: saline/ alkaline	None
389.1-388.9	Badlands: moderately steep to very steep barren shale bedrock	Badlands	20-40	VS	Massive rock	M-H	L	Poor: quantity	None

APPENDIX A-3c CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE NORTHWEST EXPANSION PROJECT (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
390.8-390.6 390.3-389.9 388.9-387.6	Youjay-Westvaco-Horsley Complex: very shallow to moderately deep, well drained to somewhat excessively well drained, sandy clay loam to sandy loam soils; on nearly level to undulating residual upland plains	Youjay	6-40	S	Clay loam	M-H	M	Poor: quantity, saline/alkaline	None
		Westvaco	2-6	MD	Sandy clay loam	L-M	M	Poor: saline/alkaline	None
		Horsley	2-6	VS	Sandy clay loam	L-M	M	Poor: quantity	None
391.2-390.8	Huguston-Teagulf Complex: shallow to moderately deep, well drained, sandy to fine sandy loam soils, on gently sloping to sloping residual uplands over sandstone bedrock	Huguston	8-30	S	Sandy loam	M-H	M	Poor: quantity	None
		Teagulf	8-30	MD	Fine sandy loam	M-H	M	Fair: quantity	None
COLORADO PLATEAU Vernal Station									
329.8	Typic Torriorthents-Lithic Calciorthids-Lithic Natrargids Association: shallow, well drained, clay loam to sandy loam soils; on undulating to rolling slopes	N/A	5-20	S	Clay loams to sandy loams	M	M	Poor: quantity	None
Rangley A Loop									
277.7-277.6 275.7-273.4	Turley: deep, well drained, fine sandy loam soils; on fans alluvial valley floors, and low terraces	Turley	0-8	D	Fine sandy loam	L	M	Good	None
277.6-276.8	Moyerson: shallow, well drained, stony clay loam soils;on ridges and sideslopes of dissected plateaus	Moyerson	15-65	S	Stony clay loam	H	L	Poor: quantity, stones	None
276.8-275.7 272.8-271.7	Uffens: deep, well drained, loamy soils; on fans and low terraces	Uffens	0-5	D	Loam	L	L	Fair to Poor: saline/alkaline	None
273.4-273.3 266.0-265.3 253.1-253.0	Torriorthents Rock Outcrop Complex: very shallow to moderately deep, well drained to excessively drained, loamy to channery loam soils; on rough and eroded areas on mountains, hills, ridged, and canyonsides	Torriorthents	15-90	VS-MD	Loam, channery	H	M	Poor to Fair: quantity	Some
		Rock outcrop	15-90	VS	Massive rock	L	L	Poor: quantity	None

APPENDIX A-3c CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE NORTHWEST EXPANSION PROJECT (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
273.3-273.1 272.9-272.8 271.7-271.5 252.7-252.2	Rentsac-Moyerson-Rock Outcrop Complex: very shallow to shallow, well drained, channery loam to stony clay loam soils; on foothills and ridges	Rentsac	5-50	S	Channery loam	M-H	L	Poor: quantity	None
		Moyerson	15-65	S	Stony clay loam	M-H	L	Poor: quantity, stones	None
		Rock outcrop	5-65	VS	Massive rock	L	L	Poor: quantity	None
273.1-272.9 271.5-271.4 269.6-269.3 266.8-266.0 260.8-260.7 259.7-259.6 259.1-258.9 258.5-258.2 257.7-257.5 257.2-257.1 253.5-253.1 253.0-252.7	Torrifluvents: moderately deep to deep, well drained soils consisting of sandy loamy, and clayey alluvium that is gullied	Torrifluvents	0-5	MD-D	Sands, loams, clay loams	M-H	M	Fair	Some
271.4-269.6 269.3-266.8 265.3-260.8 260.7-259.7 259.6-259.1 258.9-258.5 258.2-257.7 257.5-257.2 257.1-253.5 252.2-250.1	Tisworth: deep, well drained, fine sandy loam soils; on valley floors and broad fans	Tisworth	0-5	D	Fine sandy loam	L	M	Poor: saline/alkaline	Some
250.1-246.9	Kobar: deep, well drained, clayey soils; on fans and upland terraces	Kobar	0-3	D	Silty clay loam, silty clay	L	L	Fair: to Poor: clayey	Some
Rangley B Loop									
239.8-234.8	Battlement-Havre Loam Association: deep, well drained, loam soils; on floodplains, stream bottoms, and narrow valley bottoms	Battlement	1-8	D	Loam, clay loam, sandy loam	L	M	Good	Some
		Havre	1-8	D	Loam, clay loam, sandy loam	L	M	Good	Some
234.8-228.2	Panitchen-Cameo Association: deep, well drained, loam to fine sandy loam soils; on terraces and floodplains	Panitchen	1-6	D	Loam	L	M	Good	Some
		Cameo	1-6	D	Fine sandy loam	L	M	Good	Some

APPENDIX A-3c CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE NORTHWEST EXPANSION PROJECT (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)^a	Depth Class^f	Texture^b	Erosion Potential Water^c	Erosion Potential Wind^d	Reclamation Potential Limitations^e	Cropland
228.2-226.7	Fruita-Avalon-Youngston-Badlands Association: deep, well drained, loam, fine sandy loam, and badland soils; on alluvial fans, valley bottoms, low terraces, flood plains, benches, ridgetops and badlands	Fruita	3-12	D	Clay loam, loam	L-M	M	Good	Some
226.4-224.0		Avalon	3-12	D	Loam, sandy loam	L-M	M	Good	Some
223.9-223.2		Youngston	1-6	D	Loam	L	M	Good	Some
		Badlands	10-65	VS	Rock	M-H	L	Poor: quantity	Some
226.7-226.4	Chipeta-Cameo Association: shallow to deep, well drained silty clay loam to fine sandy loam soils; on low rolling hills ridges, toe slopes, floodplains, and low terraces	Chipeta	3-30	S	Silty clay loam	M-H	M	Poor: quantity	Some
		Cameo	1-6	D	Fine sandy loam	L	M	Good	Some
224.0-223.9	Persayo Silt Loam: shallow, well drained, silt loam soils; on upland hills and ridges	Persayo	3-25	S	Silt loam	M-H	M	Poor: saline/alkaline, quantity	None
223.2-223.7	Billings Silty Clay Loam: deep, well drained, silty clay loam soils; on flood plains and low terraces	Billings	0-3	D	Silty clay loam	M	L	Good	None
Cisco Loop									
195.6-186.8	Chipeta-Killpack-Bluefat Association: very shallow to deep, well drained, silty clay loam to loamy soils; on highly dissected uplifted pediments, ridges, and broad plains	Chipeta	1-10	VS	Silty clay loam	L-M	M	Poor: quantity, droughty	None
186.3-184.3		Killpack	1-10	MD	Silty clay loam	L-M	M	Poor: droughty	None
184.1-179.3		Bluefat	2-25	MD	Silty clay	L-H	L	Poor: droughty, saline	None
186.8-186.3 179.3-179.0	Toddler-Ravola-Glenton Association: very deep, well drained, silt loam to fine sandy loam soils; on floodplains, along drainage ways and on valley flats	Toddler	0-3	VD	Silt loam, fine sandy loam	L	M	Poor: saline, droughty	None
		Ravola	0-3	VD	Silt loam	L	M	Poor: saline, droughty	None
		Glenton	0-3	VD	Fine sandy loam	L	M-H	Poor: saline, droughty	None
184.3-184.1	Mesa-Thedalund Association: moderately deep to very deep, well drained; silty clay loam to sandy loam soils; on sideslopes of pediments and ridges and on fans	Mesa	2-6	VD	Fine sandy loam	L	M	Good	None
		Thedalund	30-50	MD	Gravelly sandy loam to silty clay loam	H	L	Poor: steep, droughty	None

APPENDIX A-3c CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE NORTHWEST EXPANSION PROJECT (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
179.0-171.8	Rock Outcrop-Nokai-Moenkopi Association: very shallow to deep, well drained, sandy loam soils; on canyon floors and benches	Rock outcrop	__	VS	Massive rock	L	L	Poor: quantity, droughty	None
		Nokai	3-10	D	Sandy loam	L	M	Fair: droughty	None
		Moenlcopi	3-10	S	Fine sandy loam	L-M	M	Poor: quantity, droughty	None
171.8-169.9	Rock Outcrop-Rizno-Begay Association: very shallow to very deep, well drained, gravelly fine sandy loam to fine sandy loam soils; on structural benches, cuestas and mesas	Rock outcrop	3-15	VS	Massive rock	L	L	Poor: quantity	None
		Rizno	3-15	S	Gravelly fine sandy loam	L	L	Poor: quantity, droughty	None
		Begay	2-10	VD	Fine sandy loam	L	M	Fair: droughty	None
Moab Loop									
145.6-139-6	Throughfair-Sheppard-Nakai Association: very deep, well drained, fine sand to fine sandy loam; on terraces, canyon flows, and cuestas	Throughfair	2-8	VD	Fine sandy loam	L	M	Fair: droughty	None
		Sheppard	2-8	VD	Fine sand	L	H	Poor: droughty, erosion	None
		Nokai	3-10	D	Fine sandy loam	L	M	Fair: droughty	None
139.6-135.8 119.0-118.2 116.9-111.1	Begay-Moab-Redbank Association: moderately deep to very deep, well drained, gravelly fine sandy loam to fine sandy loam soils; on fans, valley bottoms, benches, cuestas, and escarpments	Begay	2-6	VD	Fine sandy loam	L	M	Fair: droughty	None
		Moab	10-40	MD-VD	Gravelly fine sandy loam	M-H	L	Fair to Poor: rock fragments, droughty	None
		Redbank	3-8	VD	Fine sandy loam	L	M	Fair: droughty	None
135.8-127.4 123.4-119.0 118.2-116.9	Rizno-Rock Outcrop Complex: very shallow to shallow, well drained, gravelly fine sandy loam soils; on structural benches, cuestas, and mesas	Rizno	3-15	S	Gravelly fine sandy loam	L-M	L	Poor: quantity, droughty	None
		Rock outcrop	3-15	VS	Massive rock	L	L	Poor: quantity, droughty	None
127.4-123.4	Cahona-Begay-Hagerman Association: moderately deep to very deep, well drained, fine sandy loam soils; on structural cuestas, and benches	Cahona	2-8	VD	Fine sandy loam to silty clay loam	L-M	H	Good	None
		Begay	2-6	VD	Fine sandy loam	L	H	Fair: droughty, erosion	None
		Hagerman	2-8	MD	Very fine sandy loam, sandy clay loam	M	H	Fair: quantity, erosion	None
111.1-110.8	Ustic Torriorthents-Ustollic Calciorthids Complex: shallow to very deep, well drained, cobbly and gravelly sandy loam soils; on landslides and escarpments	Ustic Torriorthents	10-60	S-VD	Cobbly sandy loam	M-H	L	Fair to Poor: droughty, quantity, slope	None
		Ustollic Calciorthids	10-60	D-VD	Gravelly sandy loam	M-H	L	Fair to Poor: droughty, alkaline, slope	None

APPENDIX A-3c CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE NORTHWEST EXPANSION PROJECT (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential		Reclamation Potential Limitations[e]	Cropland
						Water[c]	Wind[d]		
Cahone Loop									
67.9-58.3 56.7-53.9 52.8-51.6	Witt-Gladel-Sharps Association: shallow to deep, well drained, sandy loam, clay loam, and cobbly fine sandy loam soils; on mesa tops, hillsides, uplands, and ridges	Witt	3-6	D	Loam to clay loam	L	M	Good	Some
		Gladel	0-12	S	Cobbly fine sandy loam	L-M	M	Poor: quantity, cobbles	Some
		Sharps	0-12	MD	Clay loam	L-M	M	Fair: droughty, quantity	Some
58.3-56.7	Romberg-Cragola-Rock Outcrop Association: very shallow to deep, well drained clay loam soils with high coarse fragment contents on canyon sideslopes, hillsides, and benches	Romberg	25-50	D	Very stony clay loam	H	L	Fair to Poor: stoniness, slope	Some
		Cragola	25-80	S	Bouldery sandy clay loam	H	L	Poor: quantity, boulders	Some
		Rock outcrops	25-80	VS	Mesa rock	L	L	Poor: quantity	None
53.9-52.8	Sili-Zyme Association: shallow to deep, well drained, clay to clay loam soils; on knobs, ridges, hillsides, and fans	Sili	3-12	D	Clay loam and clay	L-M	M	Fair to Poor: clayey	Some
		Zyme	3-25	S	Channery clay loam	L-M	M	Poor: quantity	Some

---

[a] Slope range for soil series, pipeline may be on gentler portions of slope range.

[b] Typical textures in soil profile

[c] L(low) = <5 tons/acre/year
M(moderate) = 5-20 tons/acre/year
H(high) = 20-50 tons/acre/year
VH(very high) = >50 tons/acre/year

[d] Based on WEG (Wind Erodibility classes): L(Low) = 5-8; M(moderate) = 2-4; H(high) = 1-2; or Soil Conservation Service interpretations based on soil mapping unit descriptions

[e] Based on trenching with no selective soil handling or mitigation.

[f] Soil depth classes:
VS 0-10 inches
S 10-20 inches
MD 20-40 inches
D 40-60 inches
VD 60+ inches

APPENDIX A-4 CHARACTERSTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE TRANSWESTERN EXPANSION PROPOSAL

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential: Limitations[e]	Cropland
HIGH PLAINS Loop 1									
0-2.75	Delnorte-Sharvana Association: Shallow, Excessively to well drained, nearly level to undulating, loamy soils forming in upland sediments	Delnorte	1-8	VS	Very gravelly loam	L	L	Poor: quantity (shallow to caliche), gravelly texture	None
		Sharvana	0-3	S	fine sandy loam	L	M	Poor: quantity (shallow to caliche)	None
2.75-4.1	McCarran Association: Shallow, moderately well drained, nearly level, loamy soils forming in loamy sediments high in gypsum.	McCarran	0-1	S	loam	L	L	Poor: quantity (shallow to caliche)	None
Loop 2									
77.5-85	Kermit-Berino Association: Deep, excessively drained, undulating, sandy soils forming in eolian sand deposits on plains and low hills	Kermit	0-3	D	find sand	L	H	Poor: sandy texture, drifting sand	None
		Berino	0-3	D	fine sand	L	H	Poor: sandy texture, drifting sand	None
85-87	Simona-Pajarito Association: Shallow and deep, well drained, nearly level and gently sloping, sandy soils forming in eolian sand deposits on uplands	Simona	0-3	S	gravelly fine sandy loam	L	M	Poor: quantity (shallow to caliche), sandy texture	None
		Pajarito	0-3	VD	sandy loam	L	M	Fair: sandy texture	None
87-88	Simona-Tunuco Association: Shallow, well to excessively drained, nearly level and gently undulating, loamy and sandy soils forming in calcareous sandy sediments deposited over indurated caliche	Simona	0-3	S	fine sandy loam	L	M	Poor: quantity (shallow to caliche)	None
		Tonuco	0-3	S	loamy fine sand	L	H	Poor: quantity (shallow to caliche), sandy texture	None
Loop A									
29-55	Pastura-Deama-Darvey: Very shallow, shallow, and very deep, well drained, nearly level to moderately sloping soils; on hills, mesa sides, piedmonts, and valley sides	Pastura	0-15	S	Loam	L-H	M	Poor: quantity and coarse fragments	None
		Deama	0-30	S	Very cobbly loam	L-VH	L	Poor: quantity, coarse fragments and slope	None
		Darvey	0-5	D	Loam	L-M	M	Good: none	None

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential: Limitations[e]	Cropland
	BASIN AND RANGE Loop B								
86.6-96	Tortugas-Witt-Stroupe: Very shallow, shallow, moderately deep, and very deep, well drained, nearly level to extremely steep soils; in valleys and on hills, mesas, mountainsides and breaks	Tortugas	0-30	VS/S	Very cobbly loam	L-VH	L	Poor: quantity and coarse fragments	None
		Witt	0-9	VD	Silt loam	L-M	L	Good: none	None
		Stroupe	8-30	MD	Very cobbly clay loam or clay	M-VH	L	Poor: coarse fragments and slope	None
96-103	Harvey-Witt-Pinon Association: Gently to strongly sloping upland plains, valleys, and rolling upland ridges and hills	Harvey	0-10	D	Loam, clay loam	L-M	M	Fair: calcareous	None
		Witt	0-8	VD	Loam, silty clay loam	L-M	M	Good: none	None
		Pinon	3-25	S	Channery loam	L-H	M	Poor: quantity	None
		Penistaja	0-9	D	Fine sandy loam	L-M	M	Fair: sandy texture	None
103-105 111-118	Witt-Harvey-Manzano Association: Nearly level to strongly sloping soils formed in valley fill or mixed alluvium	Witt	1-6	D	Loam, silty clay loam	L	M	Good: none	Some
		Harvey	1-9	D	Loam, clay loam	L-M	M	Fair: calcareous	Some
		Manzano	1-5	D	Loam	L	M	Good: none	Some
105-111	Otero-Palma-Trail Association: Undulating to rolling soils formed in wind-reworked materials on upland alluvial fans	Otero	1-9	D	Fine sandy loam	L-M	M	Fair: sandy texture	None
		Palma	1-9	D	Fine sandy loam	L-M	M	Fair: sandy texture	None
		Trail	5-10	D	Fine sand	L	H	Poor: sandy texture	None
118-123	Penistaja-Steep Rock Land Association: Nearly level to strongly sloping soils on uplands, and moderately sloping to very steep rocky areas on hillsides, mesa escarpments, breaks	Penistaja	1-8	D	Fine sandy loam	L-M	M	Fair: sandy texture	None
		Steep Rock Land	-	-	-----	-	-	----	--
123-127	La Fonda-Alicia-Rock, Outcrop Association: Gently sloping to strongly sloping soils formed in alluvium from red beds; moderately sloping to very steep rock outcrops	La Fonda	1-9	D	Loam	L-M	M	Good: none	None
		Alicia	1-9	D	Loam	L-M	M	Good: none	None
		Rock Outcrop							
127-130	La Fonda-Travesilla-Rock Land Association: Gently sloping to strongly sloping and undulating soils formed in regolith and alluvium derived from sandstone, limestone, interbedded sandstones and shales, and alluvium; steep, rough, and broken rock land	La Fonda	1-9	D	Loam	L-M	M	Good: none	None
		Travesilla	3-25	S	Sandy loam	L-M	M	Poor: quantity	None
		Rock Land	-	-	----	-	-	----	--

APPENDIX A-4 CHARACTERSTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE TRANSWESTERN EXPANSION PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential: Limitations[e]	Cropland
130-131.3	Rock Land-Chimayo-Luzena Association: Gently to strongly and rolling ridge tops to steep and extremely steep mountain side slopes soils formed in igneous regolith texture	Rock Land	-	-	----	-	-	----	--
		Chimayo	30-75	S	Cobbly loam	M-VH	L	Poor: quantity and coarse fragments	None
		Luzena	0-30	S	Gravelly clay loam	L-H	L	Poor: quantity and gravelly	None
COLORADO PLATEAU Loop C									
173.3 173.5	Caliza-Bluepoint Association: Well drained to somewhat excessively drained, dominantly moderately sloping to hilly soils that are very gravelly to sandy throughout; on alluvial fans and terraces	Caliza	1-25	D	Very gravelly, loamy sand	L-M	M	Poor: gravelly texture	None
		Bluepoint	1-25	D	Loamy fine sand	L-M	H	Poor: sandy texture	None
173.5-179	Tome-Adelino Association: Nearly level to gently sloping surfaces with soils forming in moderately coarse to fine-textured alluvium deposited in floodplains and terraces, alluvial fans, and valley-filling slopes	Tome	0-3	D	Very fine sandy loam	L	M	Good to Fair: salinity	None
		Adelino	0-3	D	Fine sandy loam	L	M	Good: None	None
179-180 183-185 190-194	Prieta-Rock Land-Thunderbird Association: Gently to strongly sloping surfaces with soils forming in igneous rocks of old lava flows; steep, rough, and broken rock land	Prieta	0-15	S	Stony loam	L-M	L	Poor: quantity and coarse fragments	None
		Rock Land	-	-	----	-	-	----	--
		Thunderbird	0-15	MD	Stony clay loam, clay	L-M	L	Poor: coarse fragments and clayey texture	None
180-183 185-190 196-198	Penistaja-Prewitt-Moriarity Association: Nearly level to strongly sloping and undulating landscapes surfaces with soils forming in mixed alluvial sediments	Penistaja	0-5	D	Fine sandy loam	L	M	Fair: sandy texture	None
		Prewitt	0-5	D	Loam	L	M	Good: none	None
		Moriarity	0-5	D	Clay	L	L	Poor: clayey texture	None
194-196	Lohmiller-San Mateo Association: Nearly level to gently sloping surfaces with soils formed in mixed alluvium deposited in valley bottoms, floodplains, and terraces	Lohmiller	0-3	D	Clay loam, clay	L	L	Poor to Fair: clayey texture	None
		San Mateo	0-3	D	Loam	L	M	Good: none	None

APPENDIX A-4 CHARACTERSTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE TRANSWESTERN EXPANSION PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential: Limitations[e]	Cropland
198-200.5	Penistaja-Travesilla-Rock Land Association: Nearly level to strongly sloping and gently rolling in the valleys and on mesa and ridge tops, to steep on escarpments and side slope surfaces with soils forming in mixed alluvium and eolian deposits	Penistaja	0-5	D	Fine sandy loam	L	M	Fair: sandy texture	None
		Travesilla	1-25	S	Fine sandy loam	L-H	M	Poor: quantity	None
Loop D									
224-226 228-230 232-243	Penistaja-Prewitt-Moriarity Association: Nearly level to strongly sloping and undulalandscapes surfaces with soils forming in mixed alluvial sediments	Penistaja	0-5	D	Fine sandy loam	L	M	Fair: sandy texture	None
		Prewitt	0-5	D	Loam	L	M	Good: none	None
		Moriarity	0-5	D	Clay	L	L	Poor: clayey texture	None
226-228 230-232	Rock Land-Thunderbird Association: Gently to strongly sloping and undulating on ridge crests and mesas to steep and very steep on mesa sides, escarpments, and breaks surfaces with soils forming in regolith of basaltic rocks	Rock Land	–	–	----	–	–	----	--
		Thunderbird	0-15	MD	Stony clay loam and clay	L-M	L	Poor: coarse fragments and clayey texture	None
243-244	Prieta-Rock Land-Thunderbird Association: gently to strongly sloping surfaces with soils forming in igneous rocks of old lava flows; steep, rough, and broken rock land	Preita	0-15	S	Stony loam	L-M	L	Poor: quantity and coarse fragments	None
		Rock Land Thunderbird	0-15	MD	Stony clay loam, clay	L	L	Poor: coarse fragments and clayey texture	None
244-246	Prieta-Thunderbird Association: Gently to strongly sloping surfaces with soils forming in igneous rocks of old lava flows	Prieta	5-15	S	Stony loam	L-M	L	Poor: quantity and coarse fragments	None
		Thunderbird	0-5	MD	Stony clay loam, clay	L	L	Poor: coarse fragments and clayey texture	None
246-255 257-257.5	Moriarity-Prewitt Association: Nearly level to gently sloping landscapes with soils forming in fine-textured alluvium weathered principally from shale and deposited in valley bottoms and on floodplains and terraces of intermittent drainages	Moriarity	0-5	D	Clay	L	L	Poor: clayey texture and salinity	None
		Prewitt	0-5	D	Loam	L	M	Fair: salinity	None

APPENDIX A-4 CHARACTERSTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE TRANSWESTERN EXPANSION PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)^{a}	Depth Class^{f}	Texture^{b}	Erosion Potential Water^{c}	Erosion Potential Wind^{d}	Reclamation Potential: Limitations^{e}	Cropland
255-257	Penistaja-Valent-Palma Association: nearly level to gently sloping and undulating landscapes with soils forming in coarsely to moderately fine-textured alluvial and eolian upland deposits	Penistaja	0-5	D	Fine sandy loam	L	M	Good: none	None
257.5-260		Valent	0-5	D	Loamy fine sand	L	H	Poor: sandy texture	None
260.5-271.3		Palma	0-5	D	Fine sandy loam	L	H	Fair: sandy texture	None
260-260.5	Rock Land-Travesilla Association: Soils occur on rough, broken topography with considerable variation in local relief and formed in regolith and colluvium of sandstone and shales	Rock Land	-	-	----	-	-	----	--
		Travesilla	1-25	S	Fine sandy loam	L-H	M	Poor: quantity, coarse fragments, slope, and sandy texture	None
Loop E									
303.3-307	Penistaja-Lohmiller-Travesilla Association: Gently to strongly sloping and undulating updlands separated by broad, nearly level to gently sloping valley areas dissected by intermittent drainage courses, soils are forming in residual, weathered sandstones and shales or in alluvial and eolian sediments of similar origin	Penistaja	0-5	D	Fine sandy loam, sandy clay loam	L	M	Good: none	None
		Lohmiller	0-3	D	Clay loam	L	M	Fair: clayey texture	None
		Travesilla	1-25	S	Fine sandy loam	L-H	M	Poor: quantity	None
307-310.5	Rock Land-Travesilla Association: Soils occur on rough, broken topography with considerable variation in local relief and formed in regolith and colluvium of sandstone and shales	Rock Land							
		Travesilla	1-25	S	Fine sandy loam	L-H	M	Poor: quantity	None
310.5-314	Fruitland-Camborthids-Torrifluvents Association: Shallow to deep, moderately coarse to moderately fine-textured, nearly level to hilly soils on upland plains	Fruitland	1-8	VD	Sandy loam	L	M	Fair: sandy texture	None
		Camborthids	2-9	S-VD	Sandy loam	L	M	Good to Poor: quantity	None
		Torrifluvents	0-3	VD	Sandy loam to clay loam	L	M	Good: none	None
314-339	Cryorthents-Eutroboralfs Association: Shallow to deep, moderately coarse to fine-textured, gently sloping to steep, high mountain soils	Cryorthents	2-50	S-MD	Gravelly loam to clay loam	L-VH	M	Fair to Poor: quantity	None
		Eutroboralfs	2-9	MD-D	Sandy loam to clay	L	M	Good to Fair: quantity	None

APPENDIX A-4 CHARACTERSTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE TRANSWESTERN EXPANSION PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential: Water[c]	Erosion Potential: Wind[d]	Reclamation Potential: Limitations[e]	Cropland
339-340.8	Palma-Clovis-Trail Association: Deep, coarse to moderately fine-textured, nearly level to rolling soils on plains	Palma Clovis Trail	1-15 1-15 0-5	VD VD VD	Sandy loam Sandy clay loam Loamy fine sand	L-M L-M L	M M H	Good: none Good: none Poor: sandy texture	None None None
Loop F									
375.3-388	Rudd-Bandera-Cabezon Association: Shallow, gravelly, cobbly and stony, medium and fine-textured, undulating soils on plains and mesa tops and gently rolling to steep soils on cinder cones	Rudd	2-9	S	Very cobbly loam	L	L	Poor: quantity & coarse fragments	None
		Bandera	2-50	S-MD	Very gravelly loam	L-VH	L	Fair to Poor: quantity & gravelly texture	None
		Cabezon	2-50	S	Cobbly loam over cobbly clay over bedrock	L-VH	L	Poor: quantity, slope and coarse fragments	None
388-412	Fruitland-Camborthids-Torrifluvents Association: Shallow to deep, moderately coarse to moderately fine-texture, nearly level to hilly soils on upland plains	Fruitland Camborthids Torrifluvents	2-30 2-9 0-3	VD VD VD	Sandy loam Sandy loam Sandy loam to clay loam	L-H L L	M M M	Fair: sandy texture Good to Fair Good to Fair	None None None
412-415	Palma-Clovis	Palma	0-15	D	Loamy sand/sandy loam	L-M	M	Fair: sandy texture	None
		Clovis	0-8	VD	Sandy clay loam, sandy loam	L	M	Good: none	None
415-416.8	Tours-Navajo Association: Deep, moderately coarse to fine-textured, nearly level to gently sloping soils on floodplains	Tours	0-3	VD	Silt loam, silty clay loam	L	M	Fair: moderately fine-textured	None
		Navajo	0-1	VD	Clay	L	M	Poor: clay texture	None
Loop G									
449-457.5	Vitrandepts-Ustrochrepts-Haplustalfs: moderately deep and deep, well drained, very cindery and clayey soils; on nearly level to rolling plateaus	loamy-skeletal families	0-15	MD-D	Very cindery loam	L-M	L	Fair to Poor: cinders	None
		fine families	0-15	MD-D	Cindery clay loam, clay	L-M	L	Fair to Poor: cinders, clayey	None
457.5-465	Eutroboralfs: moderately deep and deep, well drained, very gravelly and loamy soils; on gentle sloping to sloping plateaus and alluvial fans	loamy-skeletal families	0-15	MD-D	Very gravelly loam or clay loam	L-M	L	Fair: rock fragments	None
		fine-loamy families	0-15	MD-D	Loam or clay loam	L-M	L-M	Good to Fair: quantity	None

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential: Limitations[e]	Cropland
465-485.5	Eutroboralfs-Argiborolls: moderately deep and deep, well drained, clayey and very gravelly soils; on nearly level to rolling plateaus	fine families	0-15	MD-D	Clay loam, clay	L-M	L-M	Fair to Poor: clayey texture	None
		clayey-skeletal families	0-15	MD-D	Very gravelly clay loam or clay	L-M	L	Fair to Poor: clayey texture rock fragments	None
Loop H									
526.8-543 551-552 554-556.5 561-565	Springerville-Cabezon Association: Shallow, moderately deep and deep; gravelly, cobbly, or stony soils that are dominantly silty clay and loam on nearly level plains and mesas and on steep sideslopes	Springerville	3-8	MD-D	Cobbly clay	L	L	Poor: clayey texture and coarse fragments	None
		Cabezon	8-30	VS-S	Cobbly clay or clay loam	L-M	L	Poor: quantity and clayey texture	None
543-546 549-551 552.5-554 556.5-561	Pastura-Poley-Partri Association: Deep to shallow soils on nearly level to moderately steep fans, plains, and sideslopes	Pastura	0-8	VS-S	Loam, gravelly loam	L-M	L	Poor: quantity & gravelly texture	None
		Poley	0-8	D	Sandy clay loam, clay	L-M	L	Fair: clayey texture	None
		Partri	0-3	D	Gravelly clay loam, clay	L	L	Fair: clayey texture & gravelly texture	None
546-549 552-552.5	Tortugas-Purner-Jacks Association: Very shallow, shallow, & moderately deep; gravelly, cobbly, or stony soils	Tortugas	5-45	VS-S	Very cobbly loam	L-H	L	Poor: coarse fragments, quantity	None
		Purner	2-10	VS-S	Gravelly loam	L	L	Poor: quantity & gravelly texture	None
		Jacks	5-30	MD-D	Gravelly loam, clay	L-M	L	Fair: gravelly & clayey texture	None
565-570 575-576.3	Barkerville-Gaddes-Rock Outcrop Association: Very shallow to moderately deep soils and rock outcrop on granitic hills and mountains	Barkerville	15-60	MD	Gravelly sandy loam, over sand & gravel	H-VH	M	Poor: quantity, gravelly texture, and slope	None
		Gaddes	5-30	MD	Gravelly sandy loam, sandy clay loam	M-H	L	Fair: quantity, slope	None
		Rock Outcrop	15-60	-	----	-	-	----	--
570-575	Springerville-Cabezon-Thunderbird Association: Deep to shallow soils on basaltic mesas and hills	Springerville	0-8	MD-VD	Cobbly clay	L	L	Poor: coarse fragments, & clayey texture	Some
		Cabezon	8-30	VS-S	Cobbly clay loam or clay	M-H	L	Poor: quantity, coarse fragments & clayey texture	Some
		Thunderbird	2-15	MD	Cobbly clay loam, clay	L-M	L	Fair to Poor: coarse fragments & clayey texture	Some
MOJAVE DESERT Loop I									
613.0-619 621-624	Cave Association: Very shallow and shallow lime hardpan soils on valley slopes and mesas	Cave	2-8	VS-S	Gravelly sandy loam	L-M	M	Poor: quantity	None

APPENDIX A-4 CHARACTERSTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE TRANSWESTERN EXPANSION PROPOSAL (continued)

Mileost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential: Limitations[e]	Cropland
619-621	Anthony-Vinton-Agua Association: Deep soils on alluvial fans and low terraces	Anthony	0-5	VD	Sandy loam or gravelly sandy loam	L	M	Good: none	None
		Vinton	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
		Agua	0-2	VD	Loam	L	M	Good: none	None
624-634	Cellar-House Mountain-Rock Outcrop Association: Very shallow soils and rock outcrop on hills and low mountains	Cellar	5-45	VS-S	Very gravelly sandy loam	L-H	L	Poor: quantity & gravelly texture	None
		House Mountain	15-60	VS-S	Cobbly loam	H-VH	L	Poor: quantity, coarse fragments, and slope	None
		Rock Outcrop	>60	–	----	–	–	----	--
634-644.5	Laveen-Carrizo-Antho Association: Deep soils on dissected terraces and alluvial fans	Laveen	0-5	VD	Loam	L	L	Good: none	Some
		Carrizo	0-8	VD	Very gravelly loamy fine sand	L	H	Poor: coarse fragments, sandy texture	Some
		Antho	0-5	VD	Gravelly sandy loam or sandy loam	L	M	Good: none	Some

[a] Slope range for soil series, pipeline may be on gentler portions of slope range.
[b] Typical textures in soil profile.
[c] L (low) = <5 tons/acre/year
M (moderate) = 5-20 tons/acre/year
H (high) = 20-50 tons/acre/year
VH (very high) = >50 tons/acre/year
[d] Based on WEG (Wind Erodibility Classes): L (low) = 5-8; M (moderate) = 2-4; H (high) = 1-2; or Soil Conservation Service interpretations based on soil mapping unit descriptions.
[e] Based on trenching with no selective soil handling.
[f] Soil depth classes:
VS 0-10 inches
S 10-20 inches
MD 20-40 inches
D 40-60 inches
VD 60+ inches

APPENDIX B

VEGETATION COMMUNITY TYPES

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Texture	[illegible]	[illegible]	[illegible]	Comments
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Good; none	None
		[illegible]	[illegible]	[illegible]	Loamy sand	[illegible]	[illegible]	[illegible]	None
		[illegible]	[illegible]	[illegible]	Loam	[illegible]	[illegible]	Good; none	None
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Very gravelly sandy loam	[illegible]	[illegible]	Poor; salinity & gravelly texture	None
		[illegible]	[illegible]	[illegible]	[illegible] loam	[illegible]	[illegible]	Poor; salinity, gravel fragments, and slope	None
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Loam	[illegible]	[illegible]	Good; none	None
		[illegible]	[illegible]	[illegible]	Very gravelly loamy fine sand	[illegible]	[illegible]	Poor; coarse fragments, sandy texture	None
		[illegible]	[illegible]	[illegible]	Gravelly sandy loam to sandy loam	[illegible]	[illegible]	Good; fair	None

[illegible]

VOLUME I, APPENDIX B

VEGETATION COMMUNITY TYPE DESCRIPTIONS

Mojave Desert Region

Forested Lands:

Joshua Tree Woodland. The Joshua tree woodland community type occurs in an elevational zone just above the Mojavean creosote bush scrub type, and just below the juniper woodland type. Joshua tree is the dominant overstory species, but creosote bush and blackbrush may co-dominate in some stands. The community structure and species composition of this vegetation type may closely resemble the Mojavean creosote bush scrub type, except for the differences in overstory species. This community type is a unique visual component of the Mojave Desert, and since it has a fairly limited distribution, it can be considered sensitive. Total vegetal cover ranges from 10-50 percent.

Scrublands:

Desert Saltbush Scrub. This community type occurs within the Mojave Desert adjacent to the creosote bush scrub type. This type typically occurs along the margins of dry lake beds with terminal drainage. Consequently, the soils are highly alkaline with a high clay content. Generally, a high water table is present, but the soils are rarely saturated on a perennial or intermittent basis. Typical shrub species include several species of saltbush. Total vegetal cover is sparse with little herbaceous cover in the intershrub areas (10-20 percent).

Mojavean Creosote Bush Scrub. Creosote bush dominates this community type and occurs in densities of scattered to abundant. Other common shrubs include bursage, spiny hopsage, turpentine bush, burrobush, shadscale, saltbrush and blackbrush. Intershrub areas may be quite large with diameters of 50 feet or more. The species composition of this community type varies according to environmental factors such as soil type, soil moisture, and topographic position. Joshua trees may be sparsely distributed at higher elevations and various species of cacti and yuccas may be sparsely distributed throughout this type. In washes and arroyos catsclaw, palo verde, and ironwood may occur. Understory forbs and graminoids may include Indian ricegrass, galletta, and globe mallow. The relatively sparse intershrub areas may be almost devoid of apparent vegetation during the summer and fall seasons, but if sufficient precipitation occurs in late winter, a rich and luxurious growth of annuals and perennial plants may occur. Total vegetal cover ranges from very sparse to moderate (10-50 percent).

VEGETATION COMMUNITY TYPE DESCRIPTIONS

Mojavean Shadscale Scrub. This Mojave desert community type occurs within the creosote bush scrub type in basins and valleys with alkaline soils. Salt tolerant shrub species include shadscale, greasewood, bud sage, winterfat, hopsage, and horsebrush. Characteristic understory species include Russian thistle, seepweed, poverty weed, alkali sacaton, three-awn and bottlebrush squirreltail. Total vegetal cover ranges from very sparse to moderate (5-30 percent).

Mojavean Juniper Woodland and Scrub. This community type is above and adjacent to the Joshua tree woodland type on the east slopes of the Tehachapi Mountains. This is a transitional type and has several components characteristic of the Joshua tree woodland type as well as a chaparral type. The overstory is dominated by California juniper and Joshua tree. Chaparral species include ceanothus, greasewood, and buckthorn. A large variety of perennial and annual forbs and grasses occur in the understory of this type. Total vegetal cover ranges from moderate to dense (50-80 percent).

Stabilized and Partially-Stabilized Desert Dunes. This community type is characterized by dunal topography consisting of sand dunes in varying degrees of stabilization and by sand-loving plants such as sand verbena, creosote bush, and mesquite.

Yuha Desert/Cronese Valley/Ward Chemehuevi Valley Crucifixion Thorn Unusual Plant Assemblage. Crucifixion thorn co-dominates this type with other shrubs typical of the Mojavean creosote bush scrub. The species composition and vegetative structure of this type is very similar to the Mojavean creosote bush scrub. This type has been identified as very sensitive by the BLM [1980].

Sacramento-Stepladder Mountains Teddybear Cholla Unusual Plant Assemblage. Teddybear cholla co-dominates this type with shrub species typical of the Mojavean creosote bush scrub type. Species composition and vegetative structure of this type is very similar to the Mojavean creosote bush scrub type. This type has been identified as being subject to disturbance, but not as sensitive as other unusual plant assemblages, by the BLM [1980].

Western Mojave Desert Mojave Saltbush Unusual Plant Assemblage. Mojave saltbush dominates this type. Other shrubs, forbs, and graminoids, as well as vegetative structure, that typify the Mojavean creosote bush scrub type are also characteristic of this type. This type has been identified as being subject to disturbance, but not as sensitive as other unusual plant assemblages, by the BLM [1980].

VEGETATION COMMUNITY TYPE DESCRIPTIONS

Wetland/Riparian:

Wetland/riparian. Within the Mojave desert, this type may consist of dry desert washes with scattered shrub species typical of riparian vegetation. Tamarisk is frequently a dominant species which occurs along marginally ephemeral, intermittent, and perennial stream drainages within the Mojave desert. Other co-dominant shrubs may include palo verde, ironwood, mesquite, and desert-willow. Generally this type occurs in narrow bands within the Mojavean creosote bush scrub type. Total vegetal cover ranges from sparse to dense (10-80 percent).

Agricultural lands:

Agricultural land. Alfalfa is the most common crop grown under intensive irrigation and harvested within the Mojave Desert region.

Tehachapi Mountains Region

Forested Lands:

Digger Pine-Oak Woodland. The digger pine-oak woodland type occurs on the east slope of the Tehachapi Mountains adjacent to the Mojavean juniper woodland at a higher elevational zone, and in an analogous position to the valley and foothill grassland community type on the west slope. This type is characterized by an overstory dominated primarily by Douglas oak and digger pine. In some areas, valley white oak may also be common in an open park-like structure, co-dominating with Douglas oak and digger pine. Several shrubs characteristic of the chaparral type are common in this type. Numerous species of perennial and annual forbs and grasses, many of which are exotics, occur in this type as a ground cover. Total vegetal cover ranges from moderate to very dense (50-90 percent).

Grasslands:

Valley and Foothill Grassland. This community type occurs below the digger pine-oak woodland on the lower foothills on the west slope of the Tehachapi Mountains, in the San Joaquin Valley, and the foothills on the east margin of the coast range. Within the foothills of the Tehachapi Mountains, this type resembles the understory characteristic of the digger pine-oak woodland. Annual species of exotic grasses and forbs have largely replaced the native grasses due to the historic overgrazing in the area. Total vegetal cover ranges from sparse to very dense (10-90 percent).

VOLUME I, APPENDIX B (continued)

VEGETATION COMMUNITY TYPE DESCRIPTIONS

Agricultural Lands:

Agricultural land. The most common crops grown within the Tehachapi Mountains include hay meadows, alfalfa, vineyards, and orchards.

Wetland/Riparian:

Great Valley Mixed Riparian Forest. This community type is characterized by large winter-deciduous trees with a structure ranging from a dense forest to open park-like woodland. Overstory tree species include valley sycamore, cottonwood, valley oak, willow, alder, Oregon ash, and big-leaf maple. Large grape vines may utilize these trees for support. A large variety of annual and perennial forbs and grasses cover the ground surface. Total vegetal cover ranges from dense to very dense (70-90 percent).

This general class of vegetation also includes tamarisk scrub which commonly lines the margins of ephemeral and intermittent washes and streams within this region.

San Joaquin Valley Region

Grasslands:

Valley and Foothill Grassland. This community type occurs below the digger pine-oak woodland on the lower foothills on the west slope of the Tehachapi Mountains, in the San Joaquin Valley, and the foothills on the east margin of the coast range. Within the San Joaquin Valley, this type has been converted to highly productive cropland or has been urbanized. Valley saltbush scrub and valley sink scrub community types may also occur in isolated locations within the valley and foothill grassland type. Vernal pools also occur within this type which often provide very unique habitats supporting several species of narrow endemics. Along the foothills of the east slope of the coast range, this type is dominated by red foxtail chess and red-stemmed filaree, with saltbush also occurring in varying densities. Total vegetal cover ranges from sparse to very dense (10-90 percent).

Agricultural Lands:

Agricultural land. Croplands within the San Joaquin Valley are some of the most productive in the world and include truck crops, cotton, citrus, orchards, and vineyards.

VEGETATION COMMUNITY TYPE DESCRIPTIONS

Wetland/Riparian:

Great Valley Mixed Riparian Forest. See Tehachapi Mountains region.

Colorado Plateau Region

Forested Lands:

Pinyon-Juniper Woodland. The pinyon-juniper woodland type occurs between 5500 and 7000 feet and intergrades into the juniper woodland type at lower elevations or areas with less moisture. At its upper limits, it grades into the ponderosa pine woodland type. Dominant species include one-seed and Utah juniper, Rocky Mountain and single-leaf pinyon pine. Associated species include mountain muhly, mountain brome, pine dropseed, mountain mahogany, serviceberry and snowberry, which become more prevalent at the upper limits of the vegetation type. The density of the understory species varies with relation to the density of the trees, with a sparse understory in very dense stands. Total vegetal cover ranges from 40-70 percent.

Ponderosa Pine Woodland. The ponderosa pine woodland type generally occurs above 7000 feet in elevation. Ponderosa pine is the dominant species, varying in density depending on the successional stage of the stand. Pinyon pine and juniper may be interspersed within this type at lower elevations and Douglas fir, white fir and aspen at elevations above 8000 feet and in more moist areas. The understory is dominated by grasses, including Arizona fescue, mountain muly, pine dropseed, junegrass, mountain timothy, wheatgrass and Fendler's bluegrass. Common shrubs occurring in the understory are big sagebrush, buckbrush, barberry and snowberry. Total vegetal cover ranges from 50-80 percent. This type is generally managed for its timber resource on U. S. Forest Service administered land.

Scrublands:

Sagebrush Scrub. This vegetation type is primarily dominated by low to medium height shrubs typically consisting of big sagebrush, black sagebrush, four-wing saltbush and shadscale. Sand sagebrush may occur in more sandy soils while greasewood can be dominant on alkali soils. Other shrub species that may be important constituents include rabbitbrush, horsebrush, winterfat, Mormon tea and snakeweed. Common forbs include locoweed, Indian paintbrush, phlox, lupine, and globemallow. Indian ricegrass, bluebunch wheatgrass, galleta and bottlebrush squirreltail are some of the common grass species. Total vegetal cover ranges from 30-60 percent.

Malpais. The malpais consists of lava beds with very sparse vegetal cover. Plants species that may occur include juniper, saltbush and Indian ricegrass. Generally, species present on the malpais are similar to those of the surrounding areas including pinyon-juniper woodland, ponderosa pine woodland, and plains grassland types. Total vegetal cover is sparse (0-10 percent).

Mixed Desert Shrub. This community is quite diverse in species composition and may include several dominant shrub species including Nuttall saltbush, four wing saltbush, shadscale, bud sagebrush, black sagebrush, big sagebrush, winterfat, gray horsebrush, spiny hopsage, and rabbitbrush. Highly alkaline barren areas and bluffs are also included in this type as well as greasewood along and in dry washes. Typical understory species include bottlebrush squirreltail, Indian ricegrass, needlegrass, western wheatgrass, scarlet gilia, and phlox. Total vegetal cover ranges from barren to moderate (10 to 60 percent).

Greasewood. The greasewood type is widely distributed across several geographic regions including Wyoming Basin, Colorado Plateau, Basin and Range, and Mojave Desert. This type occurs on alluvial flats associated with drainages. Soils are generally deep, alkaline, and have a high clay content. Greasewood shrubs dominate this type both in height and cover. Shadscale and other shrubs typical of the mixed desert scrub, sagebrush scrub, and tamarisk scrub types may also occur in small numbers. In areas which are adjacent to salt flats or where soil alkalinity is particularly high, this type may include iodine bush. Intershrub areas may be bare or vegetated with cheatgrass as well as other forbs and graminoids characteristic of the above-listed vegetation types. Total vegetal cover ranges from sparse to moderate (20-50 percent).

Grasslands:

Plains Grassland. This grassland type occurs on level terrain in many parts of central New Mexico and northern Arizona. Composed of short grass and mixed grass associations, the plains grasslands represent a transitional zone between the true plains grassland and the basin and range grassland. Common grass species include blue grama, heavy grama, galleta, sideoats grama, prairie junegrass, Indian ricegrass, Arizona fescue, mountain muhly, Fendler's bluegrass, western wheat grass and sacaton.

VEGETATION COMMUNITY TYPE DESCRIPTIONS

Various species of dropseed, three-awn, muhly, along with bottlebrush squirreltail are important in heavily grazed areas. Common forbs include aster, mallow, buckwheat, locoweed, clover, pigweed, cinquefoil, evening primrose and lupine. Several low growing shrub species are important, especially in overgrazed areas and include cholla, prickly pear cactus, hedgehog cactus, broom snakeweed, rabbitbrush, saltbush, sagebrush and winterfat. Total vegetal cover ranges from 40-70 percent.

Wetland/Riparian:

Wetland/riparian. This community type occurs adjacent to large perennial streams and rivers on floodplains at higher elevations within the Colorado Plateau region, particularly along Rangely Loops A and B of the Northwest Expansion Project. A sub-irrigated or high water table situation exists which is conducive to the growth of hydrophytic species. Typically, a wet meadow community occupies the majority of the floodplain area. Predominant forb and graminoid species include buttercups, asters, gentians, chickweed, sedges and rushes. This type is often cropped for hay. This type may include riparian vegetation along the streams. Riparian shrubs may include willow, narrowleaf cottonwood, red osier dogwood, stream birch, alder, and bush cinquefoil. Total vegetal cover is generally very dense (up to 100 percent).

More typical of the region are riparian zones along intermittent streams consisting of tamarisk, willow, cottonwood, and birch. Depending on the alkalinity of the soils, greasewood may also be a dominant or co-dominant (see Greasewood type description above).

Agricultural Land:

Agricultural land. Croplands within the Colorado Plateau region include irrigated pastures, alfalfa, and hayfields.

Wyoming Basin Region

Scrublands:

Mixed Desert Shrub. This type is very similar to that described for the Colorado Plateau.

VEGETATION COMMUNITY TYPE DESCRIPTIONS

Wetland/Riparian:

Wetland/riparian. Wetland/riparian that occurs within the Basin and Range Region is very similar to that described for the Colorado Plateau.

Great Plains Region

Scrublands:

Chihuahuan Creosote Scrub. Creosote bush dominates this vegetation type, occurring in densities of scattered to abundant. Tarbush, which is restricted to the Chihuahuan Desert, is another important species, co-dominating with creosote bush in many areas. Other woody species include honey mesquite, which occurs in sandy areas or along fringes of washes, whitethorn acacia along washes, broom snakeweed, which is prevalent in overgrazed areas, little leaf desert sumac, Apache plume, several species of cactus and yuccas. Intershrub areas, which often appear devoid of vegetation, may support up to thirty species of annuals and many small perennial forbs [MacMahon, 1985]. These species become more conspicuous when they bloom during periods of adequate moisture. Bunch grasses characteristic of semidesert grassland such as mesa dropseed, giant dropseed and sideoats grama may occur on upland areas while tobosa and burrograss are common in swale areas. Four-wing saltbush also occurs in swales (20-60 percent).

Grasslands:

Semi-Desert Grassland. The semidesert grassland type is a transitional community type between the low elevation desert communities and the higher elevation plains grassland and pinyon-juniper woodlands. It is characterized by a shrub-grass mixture with shrub densities ranging from scattered to abundant. Dominant species vary depending on local conditions, and include giant dropseed, mesa dropseed, sand dropseed and black grama. Depressions can be dominated by tobosa or sacaton. Associated grass species may include spike dropseed, red three-awns, plains brittlegrass, bush muhly, little bluestem and sideoats grama. Typical shrubs include creosote bush, mesquite tarbush, yuccas, sagebrush and several species of cactus. Total vegetal cover ranges from 30-70 percent.

Plains Grassland. Plains grassland within this region is very similar to that described for the Colorado Plateau.

VEGETATION COMMUNITY TYPE DESCRIPTIONS

Wetland/Riparian:

Wetland/riparian. The wetland/riparian type that occurs within this region is very similar to that described for the Colorado Plateau.

Basin and Range Region

Forested Lands:

Pinyon-Juniper Woodland. The pinyon-juniper woodland that occurs in this region is very similar to that described for the Colorado Plateau region.

Grasslands:

Plains Grassland. The plains grassland type that occurs in this region is very similar to that describe for the Colorado Plateau.

Agricultural Land: Croplands that occur within this region are very similar to those described for the Colorado Plateau.

Wetland/Riparian:

Wetland/riparian. The wetland/riparian type that occurs within this region is very similar to that described for the Colorado Plateau.

Wetland/Riparian:

Wetland/Riparian. Wetland/riparian types that occur within the Basin and Range Region is very similar to that described for the Colorado Plateau.

Great Plains Region

Shrublands:

Chihuahuan Creosotebush Desert. Creosote bush dominates this vegetation type [illegible] Tarbush, which is restricted to the Chihuahuan Desert, is another important species, co-dominating with creosote bush in many areas. Other woody species include honey mesquite, which occurs in sandy areas or along fringes of washes, whitethorn acacia along washes, broom snakeweed which is prevalent in overgrazed areas, [illegible] cactus and yuccas. Intervening areas, which often appear devoid of vegetation, may support up to [illegible] species of annuals and many small perennial forbs ([illegible]). These species become more conspicuous when they bloom during periods of adequate moisture. Bunch grasses characteristic of semidesert grassland such as mesa dropseed, giant dropseed and alkali [illegible] may occur on sandier areas while tobosa and burrograss are common in swales. [illegible] (10-60 percent).

Grasslands:

Semidesert Grassland. The semidesert grassland type is a transitional community type between the low elevation desert communities and the higher elevation plains grassland and pinyon-juniper woodlands. It is characterized by a shrub-grass mixture with shrub densities ranging from scattered to abundant. Dominant species vary depending on local conditions, and include giant dropseed, mesa dropseed, sand dropseed and black grama. Depressions can be dominated by tobosa or sacaton. Associated grass species may include spike dropseed, red three-awns, plains bristlegrass, bush muhly, little bluestem and sideoats grama. Typical shrubs include creosote bush, mesquite, tarbush, yuccas, snakebrush and several species of cactus. Total vegetal cover ranges from 10-75 percent.

Plains Grassland. Plains grassland within this region is very similar to that described for the Colorado Plateau.

APPENDIX C

PLANT SPECIES OF SPECIAL CONCERN

C-1 Mojave Pipeline Proposal
C-2 El Dorado Pipeline Proposal
C-3 El Paso Expansion Proposal
  a Base Case and 600 MMcfd Alternatives
  b Northwest Expansion Project
C-4 Transwestern Expansion Proposal

APPENDIX C-1 PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE PROPOSED MOJAVE PIPELINE, ASSOCIATED COMPONENTS, AND ALTERNATIVES

Project Component	Geographic Region	Common Name	Scientific Name	Status^{abc}	Community Type	Habitat/ Flowering Time
Transfer Line	Mojave Desert	Barrel cactus	Ferocactus acanthodes var. acanthodes	C2 CNPS-3(?-3-2)	Mojavean creosote bush scrub	Gravelly or rocky hillsides, canyon walls, alluvial fans, and wash margins from 200 to 2000 feet. April/May
Mainline	Mojave Desert	Barrel cactus	Ferocactus acanthodes var. acanthodes	C2 CNPS-3(?-3-2)	Mojavean creosote bush scrub	Gravelly or rocky hillsides, canyon walls, alluvial fans, and wash margins from 200 to 2000 feet. April/May
		Howe's hedgehog cactus	Echinocereus engelmannii var. howei	C2 CNPS-1(3-2-3)	Mojavean cresote bush scrub	Desert hills and flats. April/May.
		Crucifixion thorn	Castela emoryi	CNPS-2(3-1-1)	Mojavean creosote bush scrub	Dry gravelly places. June/July
		Sand linanthus	Linanthus arenicola	C3c CNPS-2(1-2-1)	Joshua tree woodland	Gypsum soil. Mar/April
		Mojave fish hook cactus	Sclerocactus polyancistrus	C3c CNPS-4(1-2-2)	Mojavean creosote bush scrub	Gravelly mesas and slopes. April/June
		Jaeger milkvetch	Astragulus jaegerianus	C2 CNPS-1(3-1-3)	Mojavean creosote bush scrub, Joshua tree woodland	Dry, stony hillsides and desert mesas. April/June
		Robison's monardella	Monardella robisonii	C2 CNPS-1(3-1-3)	Joshua tree woodland	Rocky areas. June
		Barstow wooly sunflower	Eriophyllum mohavense	C2 CNPS-1(2-2-3)	Mojavean creosote bush scrub	Fine gravelly areas and sandy washes of level or sloping terrain. April/May
		Desert cymopterus	Cymopterus deserticola	C2 CNPS-1(3-2-3)	Mojavean creosote bush scrub	Fine to coarse, loose, sandy soil of flats in old dune areas with deep, well drained sand. March/May
		Pholisma	Pholisma arenarium	C2	Mojavean creosote bush scrub, Desert dunes	Sandy areas (dunes or sandy washes). Parasitic on roots of shrubs. April/July
		Mojave spineflower	Chorizanthe spinosa	C3c CNPS-4(1-1-3)	Mojavean creosote bush scrub	Sandy washes and flats. April/July.

Project Component	Geographic Region	Common Name	Scientific Name	Status[abc]	Community Type	Habitat/ Flowering Time
		Red rock tarweed	*Hemizonia arida*	C1 CNPS-1(3-2-3) CA-R	Mojavean creosote bush scrub, Tamarisk scrub	Washes along ephemeral seeps and streams and on adjacent sand flats in moist, subalkaline, gravelly sand. April/ November
	Tehachapi Mtns.	Fort Tejon yarrow	*Erophyllum lanatum* var. *hallii*	C2 CNPS-1(3-2-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Rocky canyon at Fort Tejon between 3500 to 4000 feet. June/July
		Piute cypress	*Cupressus nevadensis*	C3c CNPS-4(1-1-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Dry slopes between 4000 to 6000 feet. February/March
		Kern buckwheat	*Eriogonum kennedyi* var. *pinicola*	C2 CNPS-1(3-1-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Dry, exposed ridgetops. May/June
		Greenhorn Calico monkey flower	*Mimulus pictus*	C3c CNPS-4(1-1-3)	Digger pine-oak woodland	Granite rock outcrops. April/May
	San Joaquin Valley	Comanche Point layia	*Layia leucopappa*	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Moist benches. March/April
		Bakersfield saltbush	*Atriplex tularensis*	C1 CNPS-1(3-3-3) CA-E	Valley and foothill grassland	Alkali sinks and alkali plains. June/October
		Bakersfield beavertail cactus	*Opuntia basilaris* var. *treleasei*	C1 CNPS-1(3-3-3)	Valley and foothill grassland	On a variety of soil types on low hills adjacent to valley farmlands, mesas and along dry river and stream beds. May
		Hispid bird's-beak	*Cordylanthus mollis* ssp. *hispidus*	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Saline flats. June/October
		Vaseks clarkia	*Clarkia calientensis*	C2 CNPS-1(3-1-3)	Valley and foothill grassland	No data
		California jewel flower	*Caulanthus californicus*	C2 CNPS-3(?-?-3) CA-E	Valley and foothill grassland	Dry plains and slopes below 3000 feet. February/May

Project Component	Geographic Region	Common Name	Scientific Name	Status abc	Community Type	Habitat/ Flowering Time
		Valley saltbush	*Atriplex patula* ssp. *spicata*	C2 CNPS-to common	Valley and foothill grassland	Alkali sinks. April/September
		Tulare pseudobahia	*Pseudobahia peirsonii*	C2 CNPS-1(3-3-3) CA-E	Valley and foothill grassland	Adobe soil. March/April
		Congdon's eatonella	*Eatonella congdonii*	CNPS-4(1-1-3)	Valley and foothill grassland	Alkali sink. March/April
		Hoover's eriastrum	*Eriastrum hooveri*	C-2 CNPS-4(1-1-3)	Valley and foothill grassland	Rolling Plains. April/June
		Slough thistle	*Cirsium crassicaule*	C2 CNPS-2(2-2-3)	Valley and foothill grassland	Usually on banks of streams, washes, sloughs, or canals, moist wet places. June/August
		Coville's navarretia	*Navarretia setiloba*	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Heavy soils-red gravelly, clay or gravelly loam soils. April/June
		Cottony buckwheat	*Eriogonum gossypinum*	C2 CNPS-4(2-2-3)	Valley and foothill grassland	On decomposed granite and loamy soils. April/September
		Lost Hills saltbush	*Atriplex vallicola*	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Dried rainpools and flats. June/August
		Kern mallow	*Eremalche kernensis*	C2 CNPS-1(2-3-3)	Saltbush scrub	Dry sandy loam soil. April/May
		Striped adobe lily	*Frittlaria striata*	C2 CNPS-1(3-3-3) CA-T	Valley and foothill grassland to Digger pine-oak woodland	On heavy clay soil. February/April
Kern Lateral	San Joaquin Valley	Comanche Point layia	*Layia leucopappa*	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Moist benches. March/April
		Bakersfield saltbush	*Atriplex tularensis*	C1 CNPS-1(3-3-3) CA-E	Valley and foothill grassland	Alkali sinks and alkali plains. June/October

Project Component	Geographic Region	Common Name	Scientific Name	Status abc	Community Type	Habitat/ Flowering Time
		Bakersfield beavertail cactus	Opuntia basilaris var. treleasei	C1 CNPS-1(3-3-3)	Valley and foothill grassland	On a variety of soil types on low hills adjacent to valley farmlands, mesas and along dry river and stream beds. May
		Hispid bird's-beak	Cordylanthus mollis ssp. hispidus	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Saline flats. June/October
		Vaseks clarkia	Clarkia calientensis	C2 CNPS-1(3-1-3)	Valley and foothill grassland	No data
		California jewel flower	Caulanthus californicus	C2 CNPS-3(?-?-3) CA-E	Valley and foothill grassland	Dry plains and slopes below 3000 feet. February/May
		Valley saltbush	Atriplex patula ssp. spicata	C2 CNPS	Valley and foothill grassland	Alkali sinks. April/September
		Tulare pseudobahia	Pseudobahia peirsonii	C2 CNPS-1(3-3-3) CA-E	Valley and foothill grassland	Adobe soil. March/April
		Congdon's eatonella	Eatonella congdonii	CNPS-4(1-1-3)	Valley and foothill grassland	Alkali sink. March/April
		Hoover's eriastrum	Eriastrum hooveri	C2 CNPS-4(1-1-3)	Valley and foothill grassland	Rolling Plains. April/June
		Slough thistle	Cirsium crassicaule	C2 CNPS-2(2-2-3)	Valley and foothill grassland	Usually on banks of streams, washes, sloughs, or canals, moist wet places. June/August
		Coville's navarretia	Navarretia setiloba	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Heavy soils-red gravelly, clay or gravelly loam soils. April/June
		Cottony buckwheat	Eriogonum gossypinum	C2 CNPS-4(2-2-3)	Valley and foothill grassland	On decomposed granite and loam soils. April/September
		Lost Hills saltbush	Atriplex vallicola	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Dried rainpools and flats. June/August
		Kern mallow	Eremalche kernensis	C2 CNPS-1(2-3-3)	Saltbush scrub	Dry sandy loam soil. April/May

Project Component	Geographic Region	Common Name	Scientific Name	Status ^{abc}	Community Type	Habitat/ Flowering Time
		Striped adobe lily	Frittlaria striata	C2 CNPS-1(3-3-3) CA-T	Valley and foothill grassland to Digger pine-oak woodland	On heavy clay soil. February/ April
Alternative A	Mojave Desert	Barrel cactus	Ferocactus acanthodes var. acanthodes	C2 CNPS-3(?-3-2)	Mojavean creosote bush scrub	Gravelly or rocky hillsides, canyon walls, alluvial fans and wash margins from 200 to 2000 feet. April/May
Alternative B	Mojave Desert	Barrel cactus	Ferocactus acanthodes var. acanthodes	C2 CNPS-3(?-3-2)	Mojavean creosote bush scrub	Gravelly or rocky hillsides, canyon walls, alluvial fans and wash margins from 200 to 2000 feet. April/May
		Sand linanthus	Linanthus arenicola	C3c CNPS-2(1-2-1)	Joshua tree woodland	Gypsum soil. March/April
		Mojave fish hook cactus	Sclerocactus polyancistrus	C3c CNPS-4(1-2-2)	Mojavean creosote bush scrub	Gravelly mesas and slopes. April/June
		Jaeger milkvetch	Astragulus jaegerianus	C2 CNPS-1(3-1-3)	Mojavean creosote bush scrub, Joshua tree woodland	Dry, stony hillsides and desert mesas. April/June
		Barstow eriophyllum	Eriophyllum mohavense	C2 CNPS-1(2-2-3)	Mojavean creosote bush scrub	Fine gravelly areas and sandy washes of level or sloping terrain. April/May
		Desert cymopterus	Cymopterus deserticola	C2 CNPS-1(3-2-3)	Mojavean creosote bush scrub	Fine to coarse, loose, sandy soil of flats in old dune areas with deep, well drained sand. March/May
		Pholisma	Pholisma arenarium	C2	Mojavean creosote bush scrub Desert dunes	Sandy areas (dunes or sandy washes). Parasitic on roots of shrubs. April/May
		Mojave spineflower	Chorizanthe spinosa	C3c CNPS-4(1-1-3)	Mojavean creosote bush scrub	Sandy washes and flats. April/ July.

Project Component	Geographic Region	Common Name	Scientific Name	Status abc	Community Type	Habitat/ Flowering Time
		Red rock tarweed	Hemizonia arida	C1 CNPS-1(3-2-3) CA-R	Mojavean creosote bush scrub	Washes along ephemeral seeps and streams and on adjacent sand flats in moist, subalkaline, gravelly sand. April/ November

[a] Federal candidates and federally listed plants:
FE = Federally listed, endangered
FT = Federally listed, threatened
C1 = Enough data are on file to support the federal listing
C1* = Enough data are on file to support the federal listing presumed extinct
C2 = Threat and/or distribution data are insufficient to support federal listing
C2* = Threat and/or distribution data are insufficient to support federal listing; plant presumed extinct
C3a = Extinct
C3b = Taxonomically invalid
C3c = Too widespread and/or not threatened

[b] State listed plants:
CA-R = California State listed, rare
CA-E = California State listed, endangered
CA-T = California State listed, threatened
NV-E = Nevada State listed, designated endangered

[c] California Native Plant Society R-E-D Code
R (Rarity)
1 - Rare, but found in sufficient numbers and distributed widely enough that the potential for extinction or extirpation is low at this time.
2 - Occurrence confined to several populations or to one extended population.
3 - Occurrence limited to one or a few highly restricted populations, or present in such small numbers that it is seldom reported.
E (Endangerment)
1 - Not endangered
2 - Endangered in a portion of its range
3 - Endangered throughout its range
D (Distribution)
1 - More or less widespread outside California
2 - Rare outside California
3 - Endemic to California

Where CNPS-4 refers to the number list the plant occurs in:

CNPS - 1A = Plants presumed extinct in California
1B = Plants rare and endagered in California and elsewhere
2 = Plants rare and endangered in California, but more common elsewhere
3 = Plants about which CNPS needs more information
4 = Plants of limited distribution (a watch list)

---

[d] California Department of Fish and Game, Natural Diversity Data Base

SPECIFIC- Represented by a small circle (1/5-mile radius) or bounded area on the overlays. Source information is accurate and detailed, enabling NDDB to map the occurrence within 80 acres of the actual sighting or collection or the element occurs in suitable habitat throughout an area of approximately 80 acres. All bounded areas regardless of size are considered "specific" locations.

NON-SPECIFIC- Represented by a medium circle (1-mile radius) on overlays. Source information is not detailed enough for NDDB to map the locality exactly. The actual location is within the circle of 1-mile radius shown on the overlays or the element occurs in suitable habitat throughout an area approxiamtely 1 mile in radius.

GENERAL- Indicated by large circle (5-mile radius) on the overlays. Source information is only detailed enough for NDDB to map the occurrence within a 5-mile radius or the element perhaps including the entire 5-mile radius shown, but exact boundaries are not known.

[e] Information from the U.S. Fish and Wildlife service and/or Bureau of Land Management.

APPENDIX C-2 PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE PROPOSED EL DORADO PIPELINE, ASSOCIATED COMPONENTS, AND ALTERNATIVES

Project Component	Geographic Region	Common Name	Scientific Name	Status^{abc}	Community Type	Habitat/ Flowering Time
North Receipt Lateral	Mojave Desert	Barrel cactus	Ferocactus acanthodes var. acanthodes	C2 CNPS-3(?-3-2)	Mojavean creosote bush scrub	Gravelly or rocky hillsides, canyon walls, alluvial fans, and wash margins from 200 to 2000 feet. April/May
El Dorado Mainline	Mojave Desert	Barrel cactus	Ferocactus acanthodes var. acanthodes	C2 CNPS-3(?-3-2)	Mojavean creosote bush scrub	Gravelly or rocky hillsides, canyon walls, alluvial fans, and wash margins from 200 to 2000 feet. April/May
		Howe's hedgehog cactus	Echinocereus engelmannii var. howei	C2 CNPS-1(3-2-3)	Mojavean cresote bush scrub	Desert hills and flats. April/May.
		Crucifixion thorn	Castela emoryi	CNPS-2(3-1-1)	Mojavean creosote bush scrub	Dry gravelly places. June/July
		Sand linanthus	Linanthus arenicola	C3c CNPS-2(1-2-1)	Joshua tree woodland	Gypsum soil. March/April
		Mojave fish hook cactus	Sclerocactus polyancistrus	C3c CNPS-4(1-2-2)	Mojavean creosote bush scrub	Gravelly mesas and slopes. April/June
		Jaeger milkvetch	Astragulus jaegerianus	C2 CNPS-1(3-1-3)	Mojavean creosote bush scrub, Joshua tree woodland	Dry, stony hillsides and desert mesas. April/June
		Robison's monardella	Monardella robisonii	C2 CNPS-1(3-1-3)	Joshua tree woodland	Rocky areas. June
		Barstow wooly sunflower	Eriophyllum mohavense	C2 CNPS-1(2-2-3)	Mojavean creosote bush scrub	Fine gravelly areas and sandy washes of level or sloping terrain. April/May
		Desert cymopterus	Cymopterus deserticola	C2 CNPS-1(3-2-3)	Mojavean creosote bush scrub	Fine to coarse, loose, sandy soil of flats in old dune areas with deep, well drained sand. March/May
		Pholisma	Pholisma arenarium	C2	Mojavean creosote bush scrub, Desert dunes	Sandy areas (dunes or sandy washes). Parasitic on roots of shrubs.April/July
		Mojave spineflower	Chorizanthe spinosa	C3c CNPS-4(1-1-3)	Mojavean creosote bush scrub	Sandy washes and flats. April/July.

APPENDIX C-2 PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE PROPOSED EL DORADO PIPELINE, ASSOCIATED COMPONENTS, AND ALTERNATIVES

Project Component	Geographic Region	Common Name	Scientific Name	Status^{abc}	Community Type	Habitat/ Flowering Time
		Red rock tarweed	Hemizonia arida	C1 CNPS-1(3-2-3) CA-R	Mojavean creosote bush scrub, Tamarisk scrub	Washes along ephemeral seeps and streams and on adjacent sand flats in moist, subalkaline, gravelly sand. April/ November
	Tehachapi Mtns.	Fort Tejon yarrow	Erophyllum lanatum var. hallii	C2 CNPS-1(3-2-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Rocky canyon at Fort Tejon between 3500 to 4000 feet. June/July
		Piute cypress	Cupressus nevadensis	C3c CNPS-4(1-1-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Dry slopes between 4000 to 6000 feet. February/March
		Kern buckwheat	Eriogonum kennedyi var. pinicola	C2 CNPS-1(3-1-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Dry, exposed ridgetops. May/June
		Greenhorn Calico monkey flower	Mimulus pictus	C3c CNPS-4(1-1-3)	Digger pine-oak woodland	Granite rock outcrops. April/May
	San Joaquin Valley	Comanche Point layia	Layia leucopappa	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Moist benches. March/April
		Bakersfield saltbush	Atriplex tularensis	C1 CNPS-1(3-3-3)	Valley and foothill grassland	Alkali sinks and alkali plains. June/October
		Bakersfield beavertail cactus	Opuntia basilaris var. treleasei	C1 CNPS-1(3-3-3) CA-E	Valley and foothill grassland	On a variety of soil types on low hills adjacent to valley farmlands, mesas and along dry river and stream beds. May
		Hispid bird's-beak	Cordylanthus mollis ssp. hispidus	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Saline flats. June/October
		Vaseks clarkia	Clarkia calientensis	C2 CNPS-1(3-1-3)	Valley and foothill grassland	No data
		California jewel flower	Caulanthus californicus	C2 CNPS-3(?-?-3) CA-E	Valley and foothill grassland	Dry plains and slopes below 3000 feet. February/May
		Valley saltbush	Atriplex patula ssp. spicata	C2 CNPS- to common	Valley and foothill grassland	Alkali sinks. April/September

APPENDIX C-2 PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE PROPOSED EL DORADO PIPELINE, ASSOCIATED COMPONENTS, AND ALTERNATIVES

Project Component	Geographic Region	Common Name	Scientific Name	Status[abc]	Community Type	Habitat/ Flowering Time
		Tulare pseudobahia	Pseudobahia peirsonii	C2 CNPS-1(3-3-3)	Valley and foothill grassland	Adobe soil. March/April
		Congdon's eatonella	Eatonella congdonii	CNPS-4(1-1-3)	Valley and foothill grassland	Alkali sink. March/April
		Hoover's eriastrum	Eriastrum hooveri	C-2 CNPS-4(1-1-3)	Valley and foothill grassland	Rolling Plains. April/June
		Slough thistle	Cirsium crassicaule	C2 CNPS-2(2-2-3)	Valley and foothill grassland	Usually on banks of streams, washes sloughs, or canals, moist wet places. June/August
		Coville's navarretia	Navarretia setiloba	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Heavy soils-red gravelly, clay or gravelly loam soils. April/June
		Cottony buckwheat	Eriogonum gossypinum	C2 CNPS-4(2-2-3)	Valley and foothill grassland	On decomposed granite and loamy soils. April/September
		Lost Hills saltbush	Atriplex vallicola	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Dried rainpools and flats. June/August
		Kern mallow	Eremalche kernensis	C2 CNPS-1(2-3-3)	Saltbush scrub	Dry sandy loam soil. April/May
		Striped adobe lily	Frittilaria striata	C2 CNPS-1(3-3-3) CA-T	Valley and foothill grassland to Digger pine-oak woodland	On heavy clay soil. February/April
East Delivery Lateral	San Joaquin Valley	Comanche Point layia	Layia leucopappa	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Moist benches. March/April
		Bakersfield saltbush	Atriplex tularensis	C1 CNPS-1(3-3-3) CA-E	Valley and foothill grassland	Alkali sinks and alkali plains. June/October
		Bakersfield beavertail cactus	Opuntia basilaris var. treleasei	C1 CNPS-1(3-3-3)	Valley and foothill grassland	On a variety of soil types on low hills adjacent to valley farmlands, mesas and along dry river and stream beds. May
		Hispid bird's-beak	Cordylanthus mollis ssp. hispidus	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Saline flats. June/October
		Vaseks clarkia	Clarkia calientensis	C2 CNPS-1(3-1-3)	Valley and foothill grassland	No data

APPENDIX C-2 PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE PROPOSED EL DORADO PIPELINE, ASSOCIATED COMPONENTS, AND ALTERNATIVES

Project Component	Geographic Region	Common Name	Scientific Name	Status[abc]	Community Type	Habitat/ Flowering Time
		California jewel flower	Caulanthus californicus	C2 CNPS-3(?-?-3)	Valley and foothill grassland	Dry plains and slopes below 3000 feet. February/May
		Valley saltbush	Atriplex patula ssp. spicata	C2 CNPS-to common	Valley and foothill grassland	Alkali sinks. April/September
		Tulare pseudobahia	Pseudobahia peirsonii	C2 CNPS-1(3-3-3)	Valley and foothill grassland	Adobe soil. March/April
		Congdon's eatonella	Eatonella congdonii	CNPS-4(1-1-3)	Valley and foothill grassland	Alkali sink. March/April
		Hoover's eriastrum	Eriastrum hooveri	C2 CNPS-4(1-1-3)	Valley and foothill grassland	Rolling Plains. April/June
		Slough thistle	Cirsium crassicaule	C2 CNPS-2(2-2-3)	Valley and foothill Grassland	Usually on banks of streams, washes, sloughs, or canals, moist wet places. June/August
		Coville's navarretia	Navarretia setiloba	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Heavy soils-red gravelly, clay or gravelly loam soils. April/June
		Cottony buckwheat	Eriogonum gossypinum	C2 CNPS-4(2-2-3)	Valley and foothill grassland	On decomposed granite and loamy soils. April/September
		Lost Hills saltbush	Atriplex vallicola	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Dried rainpools and flats. June/August
		Kern mallow	Eremalche kernensis	C2 CNPS-1(2-3-3)	Saltbush scrub	Dry sandy loam soil. April/May
		Striped adobe lily	Frittilaria striata	C2 CNPS-1(3-3-3) CA-T	Valley and foothill grassland to Digger pine-oak woodland	On heavy clay soil. February/April
Alternative A	Mojave Desert	Barrel cactus	Ferocactus acanthodes var. acanthodes	C2 CNPS-3(?-3-2)	Mojavean creosote bush scrub	Gravelly or rocky hillsides, canyon walls, alluvial fans, and wash margins from 200 to 2000 feet. April/May
		Crucifixion thorn	Castela emoryi	CNPS-2(3-1-1)	Mojavean creosote bush scrub	Dry gravelly places. June/July
		Sand linanthus	Linanthus arenicola	C3c CNPS-2(1-2-1)	Joshua tree woodland	Gypsum soil. March/April

APPENDIX C-2 PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE PROPOSED EL DORADO PIPELINE, ASSOCIATED COMPONENTS, AND ALTERNATIVES

Project Component	Geographic Region	Common Name	Scientific Name	Status^{abc}	Community Type	Habitat/ Flowering Time
		Mojave fish hook cactus	Sclerocactus polyancistrus	C3c CNPS-4(1-2-2)	Mojavean creosote bush scrub	Gravelly mesas and slopes. April/June
		Robison's monardella	Monardella robisonii	C2 CNPS-1(3-1-3)	Joshua tree woodland	Rocky areas. June
Alternative B	Tehachapi Mtns.	Fort Tejon yarrow	Erophyllum lanatum var. hallii	C2 CNPS-1(3-2-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Rocky canyon at Fort Tejon between 3500 to 4000 feet. June/July
		Greenhorn calico monkey flower	Mimulus pictus	C3c CNPS-4(1-1-3)	Digger pine-oak woodland	Granite rock outcrops. April/ May
		Piute cypress	Cupressus nevadensis	C3c CNPS-4(1-1-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Dry slopes between 4000 to 6000 feet. February/March
		Kern buckwheat	Eriogonum kennedyi var. pinicola	C2 CNPS-1(3-1-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Dry, exposed ridgetops. May/June
		Striped adobe lily	Frittilaria striata	C2 CNPS-1(3-3-3) CA-T	Valley and foothill grassland to Digger pine-oak woodland	On heavy clay soil. February/April
Alternative C	Tehachapi Mtns.	Fort Tejon yarrow	Erophyllum lanatum var. hallii	C2 CNPS-1(3-2-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Rocky canyon at Fort Tejon between 3500 to 4000 feet. June/July
		Greenhorn collico monkey flower	Mimulus pictus	C3c CNPS-4(1-1-3)	Digger pine-oak woodland	Granite rock outcrops. April/ May
		Piute cypress	Cupressus nevadensis	C3c CNPS-4(1-1-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Dry slopes between 4000 to 6000 feet. February/March
		Kern buckwheat	Eriogonum kennedyi var. pinicola	C2 CNPS-1(3-1-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Dry, exposed ridgetops. May/June
		Comanche Point layia	Layia leucopappa	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Moist benches. March/April

APPENDIX C-2 PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE PROPOSED EL DORADO PIPELINE, ASSOCIATED COMPONENTS, AND ALTERNATIVES

Project Component	Geographic Region	Common Name	Scientific Name	Status^{abc}	Community Type	Habitat/ Flowering Time
		Bakersfield beavertail cactus	Opuntia basilaris var. treleasei	C1 CNPS-1(3-3-3)	Valley and foothill grassland	On a variety of soil types on low hills adjacent to valley farmlands, mesas and along dry river and stream beds. May
		Vaseks clarkia	Clarkia calientensis	C2 CNPS-1(3-1-3)	Valley and foothill grassland	No data
		California jewel flower	Caulanthus californicus	C2 CNPS-3(?-?-3) CA-E	Valley and foothill grassland	Dry plains and slopes below 3000 feet. February/May
		Tulare pseudobahia	Pseudobahia peirsonii	C2 CNPS-1(3-3-3) CA-E	Valley and foothill grassland	Adobe soil. March/April
		Hoover's eriastrum	Eriastrum hooveri	C2 CNPS-4(1-1-3)	Valley and foothill grassland	Rolling Plains. April/June
		Slough thistle	Cirsium crassicaule	C2 CNPS-2(2-2-3)	Valley and foothill grassland	Usually on banks of streams, washes, sloughs, or canals, moist wet places. June/August
		Coville's navarretia	Navarretia setiloba	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Heavy soils-red gravelly, clay or gravelly loam soils. April/June
		Cottony buckwheat	Eriogonum gossypinum	C2 CNPS-4(2-2-3)	Valley and foothill grassland	On decomposed granite and loamy soils. April/September
		Striped adobe lily	Frittilaria striata	C2 CNPS-1(3-3-3) CA-T	Valley and foothill grassland to Digger pine-oak woodland	On heavy clay soil. February/April

[a] Federal candidates and federally listed plants:
FE = Federally listed, endangered
FT = Federally listed, threatened
C1 = Enough data are on file to support the federal listing
C1* = Enough data are on file to support the federal listing presumed extinct
C2 = Threat and/or distribution data are insufficient to support federal listing
C2* = Threat and/or distribution data are insufficient to support federal listing; plant presumed extinct
C3a = Extinct
C3b = Taxonomically invalid
C3c = Too widespread and/or not threatened

[b] State listed plants:
CA-E = California State listed, endangered
CA-T = California State listed, threatened
CA-R = California State listed, rare
NV-E = Nevada State designated endangered

[c] California Native Plant Society R-E-D Code
R (Rarity)
  1 - Rare, but found in sufficient numbers and distributed widely enough that the potential for extinction or extirpation is low at this time.
  2 - Occurrence confined to several populations or to one extended population.
  3 - Occurrence limited to one or a few highly restricted populations, or present in such small numbers that it is seldom reported.
E (Endangerment)
  1 - Not endangered
  2 - Endangered in a portion of its range
  3 - Endangered throughout its range
D (Distribution)
  1 - More or less widespread outside California
  2 - Rare outside California
  3 - Endemic to California
Where CNPS-4 refers to the number list the plant occurs in:
  CNPS - 1A = Plants presumed extinct in California
  1B = Plants rare and endagered in California and elsewhere
  2 = Plants rare and endangered in California, but more common elsewhere
  3 = Plants about which CNPS needs more information
  4 = Plants of limited distribution (a watch list)

APPENDIX C-3a PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG BASE CASE AND 600 MMcfd ALTERNATIVES OF THE EL PASO EXPANSION PROJECT

Geographic Region	Common Name	Scientific Name	Status[a]	Community Type	Habitat/Flowering Time	Loop
Colorado Plateau	Knowlton cactus	*Pediocactus knowltonii*	LE	Pinyon-juniper woodland	Gravelly soil of dry hills at about 6000 feet elevation. April/May	Blanco
	Beautiful gilia	*Gilia formosa*	C2	Sagebrush scrub	Sandstone outcrops at about 5800 feet elevation. April/May	Blanco Chaco (200/400)
	Mancos milk-vetch	*Astragalus humillimus*	LE	Sagebrush scrub	Sandstone rocky ledges of the Point lookout or Cliffhouse Sandstone formations. May	Blanco Chaco (200/400)
	Mesa Verde cactus	*Sclerocactus mesae-verdae*	LT	Sagebrush scrub	Barren clay slopes, plains, and low hills of deserts, in soil derived from the Mancos Shale or Fruitland formation. Early May	White Rock (200/400)
	Zuni fleabane	*Erigeron rhizomatus*	LT State endangered (New Mexico)	Sagebrush scrub, Plains grassland, Juniper woodland.	Steep highly erodible sandstone slopes and clay banks of the Chinle Formation in the Zuni and Datil Mtns., 7300-8000 feet elevation. June	Laguna (100/500)
	Peebles Navajo cactus	*Pediocactus peeblesianus* var. *peeblesianus*	LE	Plains grassland, Pinyon-Juniper woodland	Gravelly soils of the Shinarump Conglomerate member of the Chinle Formation. April/May	Navajo A (Base Case, 600 Case) Navajo B Window Rock A
	Gladiator milk-vetch	*Astragalus xiphordes*	C1	Plains grassland, Pinyon-Juniper woodland	Sandy soil on broken sandstone and clay bluffs at about 5200 feet elevation. May/June	Navajo A (Base Case, 600 Case) Navajo B
	Arizona bugbane	*Cimicifuga arizonica*	C1	Ponderosa pine woodland, Plains grassland	Rich soil in wooded ravines. July/August	Williams A
	Sentry milk-vetch	*Astragalus cremnophylax* var. *cremnophylax*	C1	Ponderosa pine woodland, Plains grassland	Sandy ledges and rimrock. May/June	Williams A Williams B
	Lukachukai bitterweed	*Hymenoxys helenioides*	C2	Ponderosa pine woodland, Plains grassland	Grassy openings in the ponderosa pine, mountain bush or montane zones. Late Spring/Summer	Williams A Williams B

APPENDIX C-3a PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG BASE CASE AND 600 MMcfd ALTERNATIVES OF THE EL PASO EXPANSION PROJECT (continued)

Geographic Region	Common Name	Scientific Name	Status[a]	Community Type	Habitat/Flowering Time	Loop
	Arizona virgin bower	Clematis hirsutissima var. arizonica	C2	Ponderosa pine woodland, Plains grassland	Ponderosa pine woodland at about 7000 feet elevation. May/June	Williams A Williams B
	Disturbed rabbitbrush	Chrysothamnus molestus	C2	Ponderosa pine woodland, Plains grassland	Pinyon-juniper habitats. September/November	Williams A Williams B
	Mogallon columbine	Aquilegia desertorum	C3c	Ponderosa pine woodland	Seepage on rock faces, conifer woodland at about 7500 feet and above. Summer	Leupp
	Sunset Crater beardtongue	Penstemon clutei	C3c	Ponderosa pine woodland	Volcanic cinders at about 7000 feet elevation, in the ponderosa pine zone. June/July	Leupp
	Creeping milk-vetch	Astragalus troglodytus	C3c	Ponderosa pine woodland, Plains grassland	Poor stony soil, dry slopes and flats in ponderosa pine woodland, 6500-7000 feet elevation. May/July	Leupp
	Arizona cinquefoil	Potentilla multifoliata	C3c	Ponderosa pine woodland, Plains grassland	Washes in the San Francisco Peaks area at about 6000-7500 feet elevation. May/July	Leupp
	Flagstaff pennyroyal	Hedeoma diffusum	C3c	Ponderosa pine woodland, Plains grassland	Limestone outcrops 6000-7000 feet elevation. May/June	Leupp
	Arizona ciffrose	Cowania subintegra	LE	Plains grassland, Semi-desert grassland	Gravelly clay loam soils over limestone (or possibly pale-colored tuffaceous deposits) on rolling hills, about 3500 feet elevation. April/May	Seligman
Basin & Range Region	Arizona sophora	Sophora arizonica	C3c	Semi-desert grassland	Rocky hillsides and banks of arroyos with shrub live oak. April/May	Hackberry

---

[a] Federal candidates and federally listed plants:
LE = Federally listed, endangered
LT = Federally listed, threatened
C1 = Enough data are on file to support the federal listing
C1* = Enough data are on file to support the federal listing presumed extinct
C2 = Threat and/or distribution data are insufficient to support federal listing
C2* = Threat and/or distribution data are insufficient to support federal listing; plant presumed extinct
C3a = Extinct
C3b = Taxonomically invalid
C3c = Too widespread and/or not threatened

APPENDIX C-3b PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE NORTHWEST EXPANSION PROJECT

Geographic Region	Common Name	Scientific Name	Status[ab]	Community Type	Habitat/Flowering Time	Loop
Colorado Plateau	Uinta Basin Hookless cactus	Sclerocactus glaucus	LT G3 S3	Mixed desert shrub	Gravelly to rocky hills, mesa slopes and river bottoms, seldom on badlands. May	Rangely B Cisco
	Ferron milkvetch	Astragalus musiniensis	G3 S1	Mixed desert shrub and Juniper-Pinyon woodland	Gullied knolls and stony clay benches. May/June	Rangely B
	Wetherill milkvetch	Astragalus wetherillii	C3c G3 S3	Juniper-Pinyon woodland	Sandy clay soils. May/June	Rangely B
	Jones cycladenia	Cycladenia humilus var. jonesii	LT	Mixed desert shrub	Sparsely vegetated badland hills. April/May	Cisco
	Talls catseye	Cryptantha elata	C3c G3 S3	Mixed desert shrub	Saline clay soils. April/May	Rangely B Cisco
	Cisco milkvetch	Astragalus sabulosus	C2	Mixed desert shrub	Saline clays and silts associated with the Mancos shale Formation. April/June	Cisco
	Spineless hedgehog	Echinocereus Triglochidiatus var. inermis	LE G3 S2	Juniper-pinyon Woodland	Shallow soils with bedrock exposed usually sandstone strata associated with the Morrison Formation. April/May	Moab
	Isely milkvetch	Astragalus isleyi	C3c	Mixed desert shrub and Juniper-pinyon woodland	Seleniferous and gypsiferos clays and silts associated with the Morrison Formation. March/May	Moab
	Spreading wild buckwheat	Eriogonum humivagans	PE	Juniper-pinyon woodland and sagebrush	Small hills or outwashes of white to gray, heavy clay soils associated with the Mancos Formation. June/July	Cahone

---

[a] Federal candidates and federally listed plants:
LE = Federally listed, endangered
LT = Federally listed, threatened
PE = Proposed endangered
C2 = Threat and/or distribution data are insufficient to support federal listing
C3c = Too widespread and/or not threatened

[b] State of Colorado Ranking System:
Global Rank (distribution of species worldwide)
G3 Very rare and local over range or with a very restricted range; threatened throughout range and/or 21 to 100 occurrences.
State Rank (distribution of species within state)
S1 Critically imperiled in Colorado because of extreme rarity; 1 to 5 known occurrences especially vulnerable to extirpation from Colorado.
S2 Imperiled in Colorado because of rarity and/or 6 to 20 known occurrences; of few acres; vulnerable to extirpation from Colorado.
S3 Rare in Colorado; 20 to 40 known occurrences; restricted distribution.

APPENDIX C-4 PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE PROPOSED TRANSWESTERN EXPANSION PROJECT

Geographic Region	Common Name	Scientific Name	Status[a]	Community Type	Habitat/Flowering Time	Loop
Great Plains	Neglected sunflower	*Helianthus neglectus*	C2	Chihuahuan creosote scrub	Sandy plains, near ecotone of the Havard shin oak brush and Mesquite-lotebush habitat Summer-Fall	1
	Winkler flatsedge	*Cyperus onerosus*	C2	Chihuahuan creosote scrub, Semi-desert grassland, Plains grassland	In moist loose sand and pools between sand dunes in the mesquite-lotebush habitats. July/September	1
	Gypsum wild buckwheat	*Eriogonum gypsophilum*	LT	Semi-desert grassland	Open, almost pure, gypsum in grama grassland at about 5000 feet elevation. May/June	2
	Pecos sunflower	*Helianthus paradoxa*	C1	Plains grassland, Semi-desert grassland	Marshes and moist open areas. 4000-6000 feet elevation. Summer/Fall	2 A
	Dune unicorn plant	*Proboscidea sabulosa*	C2 State endangered (New Mexico)	Semi-desert grassland	Deep sands of mostly stabilized dunes of the Kermit Soil Series in desert scrub communities, often with mesquite. July/August	A
	Kuenzler's hedgehog cactus	*Echinocereus fendleri* var. *kuenzleri*	LE	Plains grassland	Limestone ledges and rock cracks, in or just below juniper woodland at about	A
	Gypsum turnip	*Anulocaulis gypsogenus*	State sensitive (New Mexico)	Plains grassland	Gypsum beds. June/September	A
	Gypsum greenleaf	*Limonium limbatum*	C2	Plains grassland	In saline flats and depressions. June/August	A
Basin & Range Region	Threadleaf false carrot	*Aletes filifolius*	C3c State sensitive (New Mexico)	Juniper woodland	Usually rocky places in the pinyon-juniper zone, 5500-7500 feet elevation. May/August	B
	Payson's hidden flower	*Cryptantha paysonii*	State sensitive (New Mexico)	Juniper woodland	Open slopes on limestone soil, 4000-7000 feet elevation. May/July	B
Basin & Range Region Colorado Plateaus	Gypsum blazing star	*Mentzelia perennis*	C3c State sensitive (New Mexico)	Juniper woodland	Limestone hills with gypsum lens, in the juniper zone. July/August	B C
	La Jolla prairie clover	*Dalea scariosa*	C3c State sensitive (Priority 1)	Juniper woodland, Semi-desert grassland, Plains grassland	Sandy clay banks and bluffs, open sandy areas and roadsides in desert grassland and among junipers 4900-5030 feet elevation. August/September 6,000 feet elevation. May	B C

APPENDIX C-4 PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE PROPOSED TRANSWESTERN EXPANSION PROJECT (continued)

Geographic Region	Common Name	Scientific Name	Status[a]	Community Type	Habitat/Flowering Time	Loop
Basin & Range Region Colorado Plateaus	Wright's spider lily	Tradescantia wrightii	C3c State sensitive (New Mexico)	Juniper woodland, Semi-desert grassland, Plains grassland	Ledges, moist canyons, streambanks, usually on limestone. June/September	B C
Colorado Plateau	Daggerthorn Cholla	Opuntia clavata	State sensitive (New Mexico)	Semi-desert grassland, Plains grassland	Sandy soils of valleys, grassland communities, 6000-8000 feet elevation. June	C
	Grama grass cactus	Pediocactus papyracanthus	C2 State sensitive (New Mexico)	Semi-desert grassland, Plains grassland	Grama grass and galleta grasslands. April/June	C D
	Zuni fleabane	Erigeron rhizomatus	LT State endangered (New Mexico)	Great Basin desert scrub, Plains grassland, Juniper woodland	Steep highly erodible sandstone slopes and clay banks of the Chinle Formation in the Zuni and Datil Mtns., 7300-8000 feet strata. elevation. June	D
	Zuni milkvetch	Astragalus accumbens	State sensitive (New Mexico)	Great Basin desert scrub, Plains grassland, Juniper woodland	Steep highly erodible sandstone slopes and clay banks of the Chinle Formation in the Zuni and Datil Mtns., 7300-8000 feet elevation. June	D
	Wright's fishhook cactus	Mammillaria wrightii	State endangered (New Mexico)	Juniper woodland, Plains grassland, Semi-desert grassland, Great Basin desert scrub	Gravelly or sandy hills and plains, desert grassland and pinyon-juniper habitats 3000-7000 feet elevation; of widely sporadic distribution. May/August	B C D
	Sessile-flowered false carrot	Aletes sessiliflorus	State sensitive (New Mexico)	Juniper woodland, Malpais, Great Basin desert scrub	Rocky canyons and slopes, usually in basaltic or sandstone areas, 6500-8100 feet elevation. May/June	D
	Chaco milkvetch	Astragalus micromerius	State endemic (New Mexico)	Juniper woodland, Malpais, Great Basin desert scrub	Semibarrens of sandstone cliffs, on ledges and in talus, 6600-7300 feet elevation. July/August	D
	Mathew's wooly milkvetch	Astragalus mollissimus var. mathewsii	State sensitive (New Mexico)	Juniper woodland, Malpais, Great Basin desert scrub	Sandy or gravelly soils of hilltops and slopes mostly in ponderosa pine but sometimes in canyons descending to the pinyon-juniper zone, 6550-8300 feet elevation. April/June	D
	Peeble's Navajo cactus	Pediocactus peeblesianus var. peeblisianus	LE	Pinyon-juniper woodland, Plains grassland, Great Basin desert scrub	Gravelly soils of the Shinarump conglomerate member of the Chinle Formation. April/May	E F

APPENDIX C-4 PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE PROPOSED TRANSWESTERN EXPANSION PROJECT (continued)

Geographic Region	Common Name	Scientific Name	Status[a]	Community Type	Habitat/Flowering Time	Loop
	Gadiator milk-vetch	*Astragalus xiphordes*	C1	Pinyon-juniper woodland, Plains grassland, Great Basin desert scrub	Sandy soil on broken sandstone and clay bluffs at about 5200 feet elevation. May/June	F
	Arizona bugbane	*Cimicifuga arizonica*	C1	Pinyon-juniper woodland, Ponderosa pine woodland, Plains grassland	Rich soil in wooded ravines. July/August	G
	Sentry milk-vetch	*Astragalus cremnophylax* var. *cremnophylax*	C1	Pinyon-juniper woodland, Ponderosa pine woodland, Plains grassland	Sandy ledges and rimrock. May/June	G
	Lukachukai bitterweed	*Hymenoxys helenioides*	C2	Pinyon-juniper woodland, Ponderosa pine woodland, Plains grassland	Grassy openings in the ponderosa pine, mountain brush, montane zones. Late spring/summer	G
	Arizona virgin bower	*Clematis hirsutissima* var. *arizonica*	C2	Pinyon-juniper woodland, Pondersoa pine woodland, Plains grassland	Ponderosa pine woodland at about 7000 feet elevation. May/June	G
	Disturbed rabbitbrush	*Chrysothamnus molestus*	C2	Pinyon-juniper woodland, Ponderosa pine woodland, Plains grassland	Pinyon-juniper habitats. September/November	G
	Mogollon columbine	*Aquilegia desertorum*	C3c	Pinyon-juniper woodland, Ponderosa pine woodland	Seepage on rock faces, conifer woodland at about 7500 feet and above. Summer	G
	Sunset Crater beardtongue	*Penstemon clutei*	C3c	Ponderosa pine woodland	Volcanic cinders at about 7000 feet elevation, in the ponderosa pine zone. June/July	G
	Creeping milk-vetch	*Astragalus troglodytus*	C3c	Pondersoa pine woodland	Poor stony soil, dry slopes and flats in ponderosa pine woodland, 6500-7000 feet elevation. May/July	G

APPENDIX C-4 PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE PROPOSED TRANSWESTERN EXPANSION PROJECT (continued)

Geographic Region	Common Name	Scientific Name	Status[a]	Community Type	Habitat/Flowering Time	Loop
	Arizona cinquefoil	*Potentilla multifoliata*	C3c	Pinyon-juniper woodland, Ponderosa pine woodland, Plains grassland	Washes in the San Francisco Peaks area at about 6000-7500 feet elevation. June/August	G
	Flagstaff pennyroyal	*Hedeoma diffusum*	C3c	Pinyon-juniper woodland, Ponderosa pine woodland, Plains grassland	Limestone outcrops 6000-7000 feet elevation. May/July	G
	Arizona cliffrose	*Cowania subintegra*	LE	Creosote bush	Gravelly clay loam soils over limestone (or possibly pale-colored tuffaceous deposits) on rolling hills, about 3500 feet elevation. April/May	H
	Arizona sophora	*Sophora arizonica*	C3c	Pinyon-juniper woodland, Plains grassland	Rocky hillsides and banks of arroyos with shrub live oak. April/May	H
Mojave Desert	Barrel cactus	*Ferocactus acanthodes* var. *acanthodes*	C2	Mojavean creosote bush scrub	Mojavean creosote scrub, on gravelly or rocky hillsides, canyon walls, alluvial fans, and wash margins from 200-2000 feet elevation. April/May	I

[a] Federal candidates and federally listed plants:
LE = Federally listed, endangered
LT = Federally listed, threatened
C1 = Enough data are on file to support the federal listing
C1* = Enough data are on file to support the federal listing presumed extinct
C2 = Threat and/or distribution data are insufficient to support federal listing
C2* = Threat and/or distribution data are insufficient to support federal listing; plant presumed extinct
C3a = Extinct
C3b = Taxonomically invalid
C3c = Too widespread and/or not threatened

APPENDIX D

A SUMMARY OF GRAZING ALLOTMENTS

D-1 Mojave Pipeline Proposal
D-2 El Dorado Pipeline Proposal
D-3 El Paso Expansion Proposal
  a Base Case
  b 600 MMcfd Alternatives
  c Northwest Expansion Project
D-4 Transwestern Expansion Proposal

APPENDIX D-1 A SUMMARY OF LIVESTOCK GRAZING ALLOTMENTS AFFECTED BY THE MOJAVE PIPELINE PROPOSAL

	GRAZING ALLOTMENTS								PIPELINE						
State	Administration Agency[1]	Allotment	I.D. Number	Total Acres[2]	Type[3] Animal	Range	AUMS	ACRES/AUM	Milepost Start	End	Miles Affected	Acres Disturbed[4]	AUMS Affected	Percent Allotment Affected	Source
California															
Transfer Line	BLM	Wildlife Refuge	-	-	-	-	-	-	0	15	15.0	180.0	-	-	Land ownership map
	PVT	-	-	NI	-	-	-	-	15	16	1.0	12.0	-	-	" " " " "
	BLM	Ungrazed	-	-	-	-	-	-	16	17	1.0	12.0	-	-	" " " " "
Mainline	PVT	-	-	NI	-	-	-	-	0	28	28.0	336.0	-	-	Land ownership map
	BLM	Lazy Daisy	7220	451,617*	C	E	3,192	141.5	28	36	8.7	104.4	0.73	0.02	21980 California Desert Conservation Area Plan, BLM
	PVT	-	-	NI	-	-	-	-	36	42	5.8	69.6	-	-	
	BLM	Lazy Daisy	7220	451,617*	C	E	3,192	141.5	42	54	12.5	150.0	1.06	0.03	" " " " " " " " " " "
	PVT	-	-	NI	-	-	-	-	54	84	30.3	363.6	-	-	" " " " " " " " " " "
	BLM	Ludlow	-	43,300*	S	E	2,165	20.0	84	108	23.6	283.2	14.16	0.65	" " " " " " " " " " "
	BLM	Afton Canyon	7215	41,825*	C	E	359	116.5	108	117	9.2	110.4	0.95	0.26	" " " " " " " " " " "
	PVT	-	-	NI	-	-	-	-	117	123	6.5	78.0	-	-	" " " " " " " " " " "
	BLM	Afton Canyon	7215	41,825*	C	E	359	116.5	123	129	6.0	72.0	0.62	0.17	" " " " " " " " " " "
	PVT	-	-	NI	-	-	-	-	129	181	52.2	630.0	-	-	" " " " " " " " " " "
	BLM	-	26	1,645	C	P	55	29.9	181	185	4.1	49.2	1.65	0.10	1984 Draft Coast/Valley Planning Area Resource Management Plan & EIS
	PVT/Public	-	-	NI	-	-	-	-	185	308	123.0	1,476.0	-	-	
	BLM	Buena Vista Creek	19	640	S	P	107	6.0	308	309	0.8	9.6	1.60	1.49	" " " " " " " " " " " "
	PVT/Public	-	-	NI	-	-	-	-	309	317	8.3	99.6	-	-	" " " " " " " " " " " "
		Naval Petroleum	38	2,278	S	P	380	6.0	317	318	0.6	7.2	1.20	0.32	" " " " " " " " " " " "
	PVT	-	-	NI	-	-	-	-	318	325	7.0	84.0	-	-	
Kern Lateral	PVT	-	-	NI	-	-	-	-	0	45	45.0	540.0	-	-	" " " " " " " " " " " "
Alternative A	PVT	-	-	-	-	-	-	-	0	1	1.0	12.0	-	-	Land ownership map
	BLM	Wildlife refuge	-	-	-	-	-	-	1	17	17.0	204.0	-	-	" " " " " "
	PVT	-	-	-	-	-	-	-	17	18	1.0	12.0	-	-	" " " " " "
	BLM	Wildlife refuge	-	-	-	-	-	-	18	19	1.0	12.0	-	-	" " " " " "
	PVT	-	-	-	-	-	-	-	19	20	1.0	12.0	-	-	" " " " " "
	BLM	Wildlife refuge	-	-	-	-	-	-	20	24	4.0	48.0	-	-	" " " " " "
Alternative B	PVT/Public	-	-	NI	-	-	-	-	0	44	44.0	528.0	-	-	1984 Draft Coast/Valley Planning Area Resource Management Plan & EIS
	BLM	-	25	1,645	C	P	55	29.9	44	69	25.4	304.8	10.20	18.5	
	PVT/Public	-	-	NI	-	-	-	-	69	76	7.0	84.0			" " " " " " " " " " " "

---

[1] PVT = private land; BLM = Bureau of Land Management; BIA = Bureau of Indian Affairs; State = State lands; Public = Public lands.
[2] NI = Information not readily available.
[3] C = cow; S = sheep; H = horse; G = goat; E = ephemeral range; P = permanent range.
[4] Assuming 12 acres to the linear mile.
*Private and State land not included.

APPENDIX D-2 A SUMMARY OF LIVESTOCK GRAZING ALLOTMENTS AFFECTED BY THE EL DORADO PIPELINE PROPOSAL

GRAZING ALLOTMENTS									PIPELINE					
State	Administration Agency[1]	Allotment	I.D. Number	Total Acres[2]	Type[3]		AUMS	AC/AUM	Milepost		Miles Affected	Acres Disturbed[4]	AUMS Affected	Percent Allotment Affected
					Animal	Range			Start	End				
Mainline	PVT	-	-	NI	-	-	-	-	0	28	28.0	336.0	-	-
	BLM	Lazy Daisy	7220	451,617*	C	E	3,192	141.5	28	36	8.7	104.4	0.73	0.02
	PVT	-	-	NI	-	-	-	-	36	38	-	-	-	-
	PVT	-	-	NI	-	-	-	-	38	40	1.8	21.6	-	-
	BLM	Lazy Daisy	7220	451,617*	C	E	3,192	141.5	40	49	8.8	105.6	0.75	0.02
	PVT/State	-	-	NI	-	-	-	-	49	85	35.8	429.6	-	-
	BLM	Ludlow	-	43,300*	S	E	2,165	20.0	85	100	15.0	180.0	9.0	0.42
	PVT/State	-	-	NI	-	-	-	-	100	110	-	-	-	-
	PVT/Public	-	-	NI	-	-	-	-	110	140	30.0	363.6	-	-
	PVT	-	-	NI	-	-	-	-	140	154	13.9	166.8	-	-
	BLM	-	26	1,645	C	P	55	29.9	154	180	26.0	315.2	10.5	19.1
	PVT/Public	-	-	NI	-	-	-	-	180	186	6.0	72.7	-	-
	PVT/Public	-	-	NI	-	-	-	-	186	225	39.0	427.7	-	-
	PVT	-	-	NI	-	-	-	-	225	306	81.0	981.8	-	-
	BLM	Buena Vista Creek	19	640	S	P	107	6.0	306	307	0.8	9.6	1.60	1.49
	PVT/Public	-	-	NI	-	-	-	-	307	315	8.3	99.6	-	-
		Naval Petroleum	38	2,278	S	P	380	6.0	315	316	0.6	7.2	1.20	0.32
	PVT	-	-	NI	-	-	-	-	316	323	7.0	84.0	-	-
North Receipt Lateral														
	BLM	Wildlife Refuge	-	-	-	-	-	-	0	15	15.0	180.0	-	-
	PVT	-	-	NI	-	-	-	-	15	16	1.0	12.0	-	-
	BLM	Ungrazed	-	-	-	-	-	-	16	17	1.0	12.0	-	-
East Delivery Lateral														
	PVT	-	-	NI	-	-	-	-	0	45	45.0	540.0	-	-
Alternative A														
	PVT	-	-	NI	-	-	-	-	0	3	-	-	-	
	BLM	Lazy Daisy	7220	451,617*	C	E	3,192	141.5	3	15	12.5	150.0	1.06	0.03
	PVT	-	-	NI	-	-	-	-	15	45	30.3	363.6	-	-
	BLM	Ludlow	-	43,300*	S	E	2,165	20.0	45	69	23.6	283.2	14.16	0.65
	BLM	Afton Canyon	7215	41,825*	C	E	359	116.5	69	78	-	-	-	
Alternative B														
	PVT	-	-	NI	-	-	-	-	0	9	9.2	110.4	-	-
Alternative C														
	PVT	-	-	NI	-	-	-	-	0	6	5.8	69.6	-	-

---

[1] PVT = private land; BLM = Bureau of Land Management; State = State lands; Public = Public lands.
[2] NI = Information not readily available.
[3] C = cow; S = sheep; E = ephemeral range; P = permanent range.
[4] Assuming 12 acres to the linear mile.
*Private and State land not included.

APPENDIX D-3a. A SUMMARY OF LIVESTOCK GRAZING ALLOTMENTS AFFECTED BY THE EL PASO BASE CASE

GRAZING ALLOTMENTS									PIPELINE						
					Type[3]				Milepost[4]						
State	Administrating Agency[1]	Allotment	I.D. Number	Total Acres[2]	Animal	Range	AUMS	AC/AUM	Start	End	Miles Affected[5]	Acres Affected	AUMS Affected	Percent Allotment Affected[6]	Source
Arizona															
Window Rock A Loop	BIA	Open Range	-	NI	C,S,H	P	NI	125-200	119	125	5.8	69.6	.35-.56	NAP	R. Curly, J. Wiley per communication
Navajo A Loop	BIA	Open Range	-	NI	C,S,H	P	NI	125-200	157	166	9.0	108.0	.54-.87	NAP	" " " " " " "

---

[1] BIA = Bureau of Indian Affairs

[2] NI = No information available at this time.

[3] C = cows; S = sheep; H = horse; P = permanent range.

[4] To the nearest whole mile.

[5] Assuming 12 acres to the linear mile.

[6] NAP = Not applicable bcause no allotment exists.

APPENDIX D-3b. A SUMMARY OF LIVESTOCK GRAZING ALLOTMENTS AFFECTED BY THE EL PASE 600 MMcfd ALTERNATIVES

GRAZING ALLOTMENTS									PIPELINE						
State	Administration Agency[1]	Allotment	I.D. Number	Total Acres[2]	Type[3] Animal	Range	AUMS[4]	AC/AUM	Milepost[5] Start	End	Miles Affected	Acres Affected[6]	AUMS Affected	Percent Allotment Affected[7]	Source
New Mexico															
Blanco[8] Loop	BLM	Tank Mnt Comm.	5052	24,839	C	P	1944	12.7	0	-2	2.0	24.0	1.9	0.09	J. Hansen per communication
		Animas	5047	10,876	C	P	893	12.2	-2	-3	1.3	15.6	1.3	0.14	" " " " " "
		Hart Springs	5046	2,998	C	P	357	8.4	-3	-5	1.7	20.4	2.4	0.68	" " " " " "
		Knickerbocker	5037	32,860	C	P	3046	10.7	-5	-13	8.0	96.0	8.9	0.29	" " " " " "
		E. Bloomfield	5031	5,061	C	P	701	7.2	-13	-15	1.6	19.2	2.3	0.33	" " " " " "
Chaco Loop	BIA	Gallegos #1	-	9,597	C,S,H	P	90	106.6	13	19	6.5	78.0	.73	0.81	M. Gurule per communication
White Rock	BIA	Open range	-	NI	C,S,H	P	-	125-200	44	49	5.4	64.8	.32-.51	NAP	R. Curly, J. Wiley per communication
Gallup Loop	BIA	Open Range	-	NI	C,S,H	P	-	125-200	65	70	5.2	62.4	.31-.49	NAP	" " " " " " "
Arizona															
Window Rock A Loop	BIA	Open Range	-	NI	C.S,H	P	-	125-200	119	125	5.8	69.6	.35-.56	NAP	" " " " " " "
Window Rock B Loop	BIA	Open Range	-	NI	C,S,H	P	-	125-200	85	117	21.7	260.4	1.3-2.1	NAP	" " " " " " "
Navajo A Loop	BIA	Open Range	-	NI	C,S,H	P	-	125-200	157	166	9.0	108.0	.54-.87	NAP	" " " " " " "
Navajo B Loop	BIA	Open Range	-	NI	C,S,H	P	-	125-200	152	193	40.7	488.4	2.4-3.9	NAP	" " " " " " "
Leupp Loop	BIA	Open Range	-	NI	C,S,H	P	-	125-200	230	231	1.4	16.8	.08-.13	NAP	J. Bradley per communication
	USFS	Angel Turkey Tank	-	66,401(47975)	C	P	2885	16.6	231	240	9.0	108.0	6.5	0.22	" " " " " "
	Coconino	Cosnino	-	13,753(10093)	C	P	1077	9.4	240	244	4.0	48.0	5.1	0.47	" " " " " "
	BIA	Peaks	112	179,000	C	P	3600	49.7	248	250	1.5	18.0	.36	0.01	" " " " " "
Williams A Loop	Kaibab	Govt. Prairie	-	12,761	C	P	1317	9.7	264	265	1.4	16.8	1.7	0.13	" " " " " "
		Spite Hill	-	13,821	C	P	955	14.5	265	269	4.0	48.0	3.3	0.35	" " " " " "
		Sitzgreaves	-	19,637	C	P	2017	9.7	269	277	7.9	94.8	9.8	0.48	" " " " " "
Williams B Loop	Kaibab	Juan Tank	-	18,338	C	P	2706	6.8	283	286	2.6	31.2	4.5	0.17	" " " " " "
		Corva	-	10,208	C	P	1255	8.1	286	293	7.0	84.0	10.4	0.80	" " " " " "
		Double A	-	43,403	C	P	1750	24.8	284	285	1.0	12.0	0.5	0.02	" " " " " "
		Irishman Dam	-	13,271	C	P	1068	12.4	293	297	4.0	48.0	3.9	0.36	" " " " " "
Arizona															
Seligman Loop	State/PVT	-	-	NI	-	-	-	-	318	349	30	360	-	NAP	Arizona Land Ownership Map
Hackberry Loop	State/PVT	-	-	NI	-	-	-	-	416	442	26	312	-	NAP	" " " " "

---

[1] PVT = private lands; BLM = Bureau of Land Management; BIA = Bureau of Indian Affairs; State = State lands; USFS = U.S. Forest Service.

[2] NI = no information available at this time; number in parenthesis is suitable acres for grazing and number outside is total acres.

[3] C = cows; S = sheep; H = horses; G = goat; P = permanent range; E = ephemeral range.

[4] AUM's figured using only suitable acres.

[5] To the nearest whole mile.

[6] Assuming 12 acres to the linear mile.

[7] NAP = not applicable since allotments do not exist.

[8] Milepost -14.6 is the actual beginning of the line.

*Navajo Indian Irrigation Project.

APPENDIX D-3c A SUMMARY OF LIVESTOCK GRAZING ALLOTMENTS AFFECTED BY THE NORTHWEST EXPANSION PROJECT

		GRAZING ALLOTMENTS							PIPELINE						
					Type[1]				Milepost						
State	Administrating Agency	Allotment	I.D. Number	Total Acres	Animal	Range	AUMS[2]	AC/AUM	Start	End	Miles Affected[3]	Acres Affected	AUMS Affected	Percent Allotment Affected	Source
Muddy Creek Loop															
Wyoming	BLM	Carter Lease	1306	118,114	C,S	P	13,280	8.9	0.0	19.6	9.8	118.8	13.3	.1	Kemmerer Resource Management Plan, 1985
		Granger Lease	1302	248,107	C,S	P	16,587	15.0	19.6	33.5	7.0	84.8	5.6	<.1	" " " " " " " "
Green River Loop															
Wyoming	BLM	Granger Lease	1302	248,107	C,S	P	16,587	15.0	44.3	46.5	1.1	13.3	0.9	<.1	Kemmerer Resource Management Plan, 1985
		Henry's Fork Pasture E	4012	63,659	C,S,H	P	5,654	11.3	46.5	48.5	2.0	24.2	2.1	<.1	Tim Murphy, per communication
Rangley A Loop															
Colorado	BLM	Douglas Creek	6342	5,518	S	P	800	6.9	154.3	156.4	2.1	25.4	3.7	.5	B. Curtis Smith, per communication
		Twin Buttes	6346	134,602	C	P	11,361	11.8	156.4	160.6	4.2	181.8	15.4	.1	" " " " " " " "
									170.3	170.7	0.4				" " " " " " " "
									173.5	178.2	4.7				
									179.5	185.2	5.7				
		Cathedral Bluffs	6337	90,874	C	P	5,737	15.8	160.6	166.8	6.2	75.2	4.8	<.1	" " " " " " " "
		Bull Draw	6354	9,778	C	P	187	52.3	166.8	170.3	3.5	42.4	0.8	.4	" " " " " " " "
		East Douglas Creek	6356	36,071	C	P	1,805	20.0	170.7	173.5	2.8	33.9	1.7	<.1	" " " " " " " "
		Red Rock	6371	5,864	C	P	140	41.9	178.2	179.5	1.3	15.8	0.4	.3	" " " " " " " "
Rangley B Loop															
Colorado	BLM	East Salt	6602	94,278	C	P	9,930	9.5	192.5	198.2	5.7	127.3	13.4	.1	BLM, Grand Junction Resource Area
									200.8	201.4	0.6				
									204.9	209.1	4.2				
		Spink-Mitchell	6607	4,604	C	P	556	8.3	198.2	200.8	2.6	31.5	3.8	.7	" " " " " " " "
		Dry Canyon	6608	9,690	C	P	571	17.0	209.1	209.9	0.8	9.7	0.6	.1	" " " " " " " "
Cisco Loop															
Utah	BLM	Agate	5853	16,120	S	P	623	25.9	238.3	245.7	7.4	89.7	3.5	.6	Grand Resource Area Management Plan EIS, 1983
		Cisco Spring Wash	5805	58,467	C,S	P	2,573	22.7	245.7	250.3	4.6	55.8	2.4	<.1	" " " " " " " " "
		Highlands	5812	23,220	S	P	1,200	19.4	250.3	255.0	4.7	57.0	2.9	.2	" " " " " " " " "
		Taylor	5882	121,819	C	P	8,320	14.6	255.0	264.1	9.1	110.3	7.6	<.1	" " " " " " " " "
Moab Loop															
Utah	BLM	Blue Hill	5817	61,789	C	P	2,700	22.9	296.3	301.0	4.7	57.0	2.5	<.1	Grand Resource Area Management Plan EIS, 1983
		Kane Springs	5847	16,978	C	P	300	56.6	301.0	303.8	2.8	33.9	0.6	.2	" " " " " " " " "
		Hatch Point	5389	96,937	C,S	P	11,313	8.6	303.8	310.1	6.3	76.4	8.9	<.1	" " " " " " " " "
		Lisbon	5388	120,818	C	P	8,687	13.9	310.1	319.0	8.9	107.9	7.8	<.1	" " " " " " " " "
		Monticello Cowboy	4806	4,020	C	P	814	4.9	319.0	322.1	3.1	37.6	7.7	.9	BLM, San Juan Resource Area

---

[1] C = cows; S = sheep; H = horse; G = goat; P = permanent range; E = ephemeral range.
[2] AUM's figured using only suitable acres.
[3] Assuming 12 acres to the linear mile.

APPENDIX D-4 A SUMMARY OF LIVESTOCK GRAZING ALLOTMENTS AFFECTED BY THE TRANSWESTERN EXPANSION PROPOSAL

		GRAZING ALLOTMENT									PIPELINE				
State/Loop	Administrative Agency[1]	Allotment Name	I.D. Number	Total Acres[2]	Type[3] Animal	Range	AUMS[4]	AC/AUM	Milepost[5] Start	End	Miles Affected	Acres Disturbed[6]	AUMS Affected	Percent[7] Allotment Affected	Source
New Mexico															
Loop 1	PVT	-	-	NI	-	-		-	0	4	4.1	-	-	-	(Land Ownership Map of Texas)
Loop 2	BLM	Antelope Ridge	7032	77,746	C	P	12,216	6.4	78	82	4.2	50.4	7.87	.06	(D.Ashby per communication)
		Livingston Ridge	7027	62,049	C,H	P	10,116	6.1	82	84	2.3	27.6	4.52	.04	" " " " " " " "
		Key Cliff	7022	27,666	C	P	4,536	6.1	84	85	.8	9.6	1.57	.03	" " " " " " " "
		Clayton Basin	7013	57,098	C	P	11,567	4.9	85	87	2.42	29.0	5.92	.05	" " " " " " " "
Loop A	BLM	Corn	4017	8,666	C	P	1,728	5.0	B						(C. Taylor per communication)
		Kelley	3046	12,350	C	P	2,494	4.9	24	29	4.6	55.2	11.2	.45	" " " " " " " "
		McNally	3042	24,159	C,S,H	P	7,336	3.3	29	33	4.0	48.0	14.5	.20	" " " " " " " "
		Yriarts	3040	13,547	C,S	P	4,116	3.3	B		-	-	-	-	" " " " " " " "
		Rogers Ranch	3039	18,386	C,S,G	P	4,908	3.7	33	41	7.8	93.6	25.3	.14	" " " " " " " "
		Liakos	3038	5,624	C,S	P	1,488	3.8	41	44	3.2	38.4	10.1	.70	" " " " " " " "
		Hendricks	3030	10,853	C	P	3,216	3.4	44	49	4.8	57.6	16.9	.52	" " " " " " " "
	PVT	Ponders	-	10,186	C	P	2,880	3.5	49	51	1.5	18.0	5.1	.17	" " " " " " " "
	BLM	X-Bar Ranch	3020	69,488	C,S,G,H	P	18,875	3.7	51	53	1.8	21.6	5.8	.03	" " " " " " " "
Loop B	STATE/PVT	-	-	NI	-	-	-	-	87	123	36.6	439.2	-	-	(W. Abrecht per communication)
	STATE	-	-	NI	-	-	-	-	123	127	4.1	-	-	-	" " " " " " " " "
	BLM	Abo	1349	7,238	C	P	742	11.7	127	130	2.7	32.4	2.8	.37	" " " " " " " " "
		Dripping Springs	1343	3,450	C	P	523	6.6	130	131	1.25	15.0	2.3	.43	" " " " " " " " "
	PVT	-	-	NI	-	-	-	-	131	132	.5	6.0	-	-	" " " " " " " " "
Loop C	PVT	-	-	NI	-	-	-	-	174	175	1.04	-	-	-	(W. Louis per communication)
	BIA	Sedillo Grant	-	99,609	C,S,H	P	9,600	10.3	175	185	9.6	115.2	11.2	.12	" " " " " " " " "
		Edison Grant	-	9,960	C,S,H	P	1,933	5.2	185	190	5.0	60	11.53	.59	" " " " " " " " "
		Open Range	-	NI	C,S,H	P	27,200	-	190	202	12.8	177.6	-	-	" " " " " " " " "
		Unit 7A	-	8,831	C	P	1,200	7.4	B		-	-	-	-	" " " " " " " " "
		Unit 6A	-	5,430	C	P	420	12.9	B		-	-	-	-	(J. Sanchez per communication)
Loop D	BLM	ERI	445	920	C	P	151	6.1	B		-	-	-	-	" " " " " " " " "
		EVA	426	1,927	C	P	189	10.1	224	228	4.3	51.6	5.1	2.7	(L. Livingston per communication)
		San Mateo	432	1,782	C	P	336	5.3	228	238	9.8	117.6	22.2	6.6	" " " " " " " " " "
		Tailing Ponds	428	1,488	C	P	391	3.8	238	241	2.7	32.4	8.5	2.2	" " " " " " " " " "
	PVT	-	-	NI	-	-	-	-	241	248	6.45	77.4	-		" " " " " " " " " "
	BLM	D. J. Elkins	6025	NI	C	P	24	-	248	251	3.33	40	-		" " " " " " " " " "
		D.P. Elkins	6026	NI	C	P	48	-	251	257	6.25	75	-		(J. Hansen per communication)
	BIA	Thoreau Community	-	7,890	S,C,H	P	74	106.6	257	265	8.5	102	.96	.01	" " " " " " " " " "
	PVT	-	-	NI	-	-	-	-	265	274	8.2	98.4	-	-	(E. Chee per communication)

APPENDIX D-4 A SUMMARY OF LIVESTOCK GRAZING ALLOTMENTS AFFECTED BY THE TRANSWESTERN EXPANSION PROPOSAL (continued)

	GRAZING ALLOTMENT								PIPELINE						
					Type[3]				Milepost[5]						
State/Loop	Administrative Agency[1]	Allotment Name	I.D. Number	Total Acres[2]	Animal	Range	AUMS[4]	AC/AUM	Start	End	Miles Affected[6]	AUMS Disturbed	AUMS Affected	Percent[7] Allotment Affected	Source
Loop E	BIA	Open range	-	NI	C,S,H	P	-	125-200	303	310	6.5	-	-	NAP	(R. Curly, J. Wiley per communication)
Arizona															
Loop E	BIA	Open range	-	NI	C,S,H	P	-	125-200	310	340	30.0	-	-	NAP	" " " " " " " " " " " "
Loop F	BIA	Open range	-	NI	C,S,H	P	-	125-200	375	418	43.0	-	-	NAP	" " " " " " " " " " " "
Loop G	USFS Coconino N.F.	Angell Turkey Tank	-	66,401 (47975)	C	P	2,885	5.6	449	452	3.0	36	6.42	.22	(J. Bradley per communication)
		Cave Hill	-	7,572 (1507)	C	P	*	-	452	455	2.5	30	-	-	" " " " " " " " "
		Summit Black Bill	-	4,906 (3646	C	P	850	4.6	455	456	1.5	18	3.9	.46	" " " " " " " " "
		Peaks	-	200,111(180204)	C	P	12,600	5.0	456	464	7.6	91.2	18.2	.14	" " " " " " " " "
		Maxwell	-	23,307 (21009)	C	P	1,919	5.1	464	470	6.0	72.	14.1	.74	" " " " " " " " "
		Wild Bill	-	27,250 (25306)	C	P	2,695	4.1	470	472	2.0	24.	5.85	.22	" " " " " " " " "
	Kaibab	Government Prairie	-	12,761	C	P	1,371	9.7	472	476	4.0	48.	4.94	.38	(U. Zalugo, L. Ferroni per communication)
		Spitz Hill	-	13,821	C	P	955	14.5	476	481	5.0	60	4.14	.43	" " " " " " " " " " " " "
		Sitzgrieve	-	19,637	C	P	2,017	9.7	481	489	8.0	96	9.9	.49	" " " " " " " " " " " " "
Loop H	PVT/STATE	-	-	NI	-	-	-	-	528	577	49.0	588	-	-	" " " " " " " " " " " " "
Loop I	BLM	Lazy YU	2055	21,003	C	P/E	1,404	14.95	613	619	6.0	72	4.8	.34	(G. Ramos per communication)
		Black Mountain	2009	54,705	C	P/E	1,248	43.3	619	629	10.0	120	.23	.02	" " " " " " " " "
		Silver Creek	2068	86,430	C	E	NI	-	629	636	7.0	84	-	-	" " " " " " " " "
		Black Mountain	2009	54,705	C	P/E	1,248	43.3	636	645	9.0	108	.21	.02	" " " " " " " " "

---

[1] PVT = private land; BLM = Bureau of Land Management; BIA = Bureau of Indian Affairs; STATE = State Lands; USFS = United States Forest Service.

[2] NI = Information not readily available, number in parenthesis is suitable acres for grazing and number outside is total acres.

[3] S = sheep; C = cows; H = horses; G = goats; P = permanent range; E = ephemeral range

[4] AUMS figured using suitable acres.

[5] B = boundary allotment.

[6] Assuming 12 acres to the linear mile.

[7] NAP = not applicable since allotments do not exist.

*Allotment not grazed due to poor soil condition.

APPENDIX E

E-1 PLANT SPECIES LIST

E-2 COMMON AND SCIENTIFIC NAMES FOR WILDLIFE SPECIES

APPENDIX E-1

COMMON AND SCIENTIFIC NAMES FOR PLANT SPECIES

Common name	Scientific name
Trees and Shrubs	
Alder	Alnus spp.
Apache plume	Fallugia paradoxa
Arizona cliffrose	Cowania subintegra
Aspen	Populus tremuloides
Barberry	Mahonia repens
Big sagebrush	Artemisia tridentata
Big-leaf maple	Acer grandidentatum
Bitterbrush	Purshia tridentata
Blackbrush	Coleogyne ramosissima
Black sagebrush	Artemisia nova
Blue Oak	Quercus douglasii
Broom snakeweed	Gutierrezia sarothrae
Buckbrush	Ceanothus spp.
Buckthorn	Rhamnus californica
Bud sagebrush	Artemisia spinescens
Burrobush	Hymenoclea salsola
Bursage	Ambrosia dumosa
California juniper	Juniperus californica
Catclaw	Acacia gregii
Ceanothus	Ceanothus spp.
Cholla	Opuntia spp.
Cottonwood	Populus spp.
Creosote bush	Larrea tridentata
Crucifixion thorn	Canotia holacantha
Desert willow	Chilopsis linearis
Desert saltbush	Atriplex spp.
Digger pine	Pinus sabiniana
Douglas-fir	Pseudotsuga menziesii
Four-wing saltbush	Atriplex canescens
Gambel's oak	Quercus gambelii
Gardner saltbush	Atriplex gardinerii
Gray horsebrush	Tetradymia spp.
Greasewood	Sarcobatus vermiculatus
Hedgehog cactus	Echinocereus spp.
Spiny hopsage	Grayia spinosa
Honey mesquite	Prosopis glandulosa
Horsebrush	Tetrademia spp.
Ironwood	Olneya tesota
Joshua tree	Yucca brevifolia
Juniper	Juniperus spp.
Little leaf desert sumac	Rhus microphylla
Mesquite	Prosopis spp.
Mormon tea	Ephedra spp.
Mountain mahogany	Cercocarpus montanus

APPENDIX E-1 (continued)

COMMON AND SCIENTIFIC NAMES FOR PLANT SPECIES

Common name	Scientific name
Trees and Shrubs (continued)	
One-seeded juniper	Juniperus monosperma
Oregon ash	Fraxinus latifolia
Palo verde	Cercidium floridum
Pinyon pine	Pinus edulis
Ponderosa pine	Pinus ponderosa
Rabbitbrush	Chrysothamnus spp.
Rocky Mountain juniper	Juniperus scopulorum
Sagebrush	Artemisia spp.
Saltbush	Atriplex spp.
Seepweed	Baccharis spp.
Serviceberry	Amelanchier spp.
Shadscale	Atriplex confertifolia
Single-leaf pinyon	Pinus monophylla
Snowberry	Symphoricarpos spp.
Spiny hopsage	Grayia spinosa
Tamarisk	Tamarix spp.
Tarbush	Flourensia cernua
Turpentine bush	Thamnosma montana
Utah juniper	Juniperus osteosperma
Valley oak	Quercus lobata
Valley sycamore	Platanus racemosa
White fir	Abies concolor
Whitethorn acacia	Acacia neovernicosa
Willow	Salix spp.
Winterfat	Ceratoides lanata
Succulents	
Barrel cactus	Ferocactus acanthodes var. acanthodes
Bakersfield beavertail cactus	Opuntia basilaris var. treleasei
Cholla	Opuntia spp.
Knowlton cactus	Pediocactus knowltonii
Kuenzler hedgehog cactus	Echinocereus fendleri var. kuenzleri
Mesa Verde cactus	Sclerocactus mesa-verde
Peebles Navajo cactus	Pediocactus peeblesianus var. peeblesianus
Prickly pear cactus	Opuntia spp.
Spanish bayonet	Yucca baccata
Spineless hedgehog cactus	Echinocereus triglochidiatus var. inermis
Teddybear cholla	Opuntia bigelovii

APPENDIX E-1 (continued)

COMMON AND SCIENTIFIC NAMES FOR PLANT SPECIES

Common name	Scientific name
Succulents (continued)	
Uinta Basin hookless cactus	Sclerocactus glaucus
Wright's fishhook cactus	Mammillaria wrightii
Yucca	Yucca spp.
Forbs and Grasses	
Alfalfa	Medicago sativa
Alkali sacaton	Sporobolus airoides
Arizona fescue	Festuca arizonica
Aster	Aster spp.
Bakersfield saltbush	Atriplex tularensis
Barstow wooly sunflower	Eriophyllum mojavense
Black grama	Bouteloua eriopoda
Blue grama	Bouteloua gracilis
Bluebunch wheatgrass	Agropyron spicatum
Bottlebrush squirreltail	Sitanion hystrix
Bromegrass	Bromus spp.
Buckwheat	Eriogonum spp.
Burrograss	Scleropogon brevifolius
Bush muhly	Muhlenbergia porteri
California jewel flower	Caulanthus californicus
Cinquefoil	Potentilla spp.
Clover	Trifolium spp.
Comanche Point layia	Layia leucopappa
Cotton	Gossypium spp.
Coville's navarretia	Navarretia setiloba
Desert cymopterus	Cymopterus deserticola
Dropseed	Sporobolus spp.
Dryland Wheat	Triticum spp.
Dune unicorn plant	Proboscidea sabulosa
Evening primrose	Oenothera spp.
Fendler's bluegrass	Poa fendleriana
Fescue	Festuca spp.
Fleabane daisy	Erigeron spp.
Galletta grass	Hillaria jamesii
Giant dropseed	Sporobolus giganteus
Gladiator milkvetch	Astragalus xiphodes
Globemallow	Sphaeralcea spp.
Grama grass	Boteloua spp.
Grape	Vitis spp.
Gypsum wild buckwheat	Eriogonum gypsophilum
Heavy grama	Bouteloua spp.
Indian ricegrass	Oryzopsis hymenoides
Indian paintbrush	Castilleja spp.

APPENDIX E-1 (continued)

COMMON AND SCIENTIFIC NAMES FOR PLANT SPECIES

Common name	Scientific name
Forbs and Grasses (continued)	
Jones cycladenia	*Cycladenia humilis* var. *jonesii*
Junegrass	*Koeleria pyrmidata*
Little bluestem	*Schizachyrium scoparium*
Locoweed	*Astragalus* spp.
Lupine	*Lupinus* spp.
Mallow	*Sphaeralcea* spp.
Mancos milkvetch	*Astragalus humillimus*
Mesa dropseed	*Sporobolus flexuosus*
Mountain brome	*Bromus marginatus*
Mountain timothy	*Phleum pratensis*
Mountain muhly	*Muhlenbergia montana*
Needlegrass	*Stipa* spp.
New Mexico feathergrass	*Stipa neomexicana*
Oak	*Quercus* spp.
Phlox	*Phlox* spp.
Pigweed	*Amaranthus* spp.
Pine dropseed	*Blepharoneuron tricholepis*
Plains brittlegrass	*Setaria leucopila*
Prairie junegrass	*Koeleria pyramidata*
Poverty weed	*Monolepis* spp.
Red foxtail chess	*Bromus rubens*
Red rock tarweed	*Hemizonia arida*
Red-stemmed filaree	*Erodium cicutarium*
Red three-awns	*Aristida longiseta*
Russian thistle	*Salsola kali*
Sand verbena	*Abronia* spp.
Sideoats grama	*Bouteloua curtipendula*
Spike dropseed	*Sporobolus contractus*
Spreading wild buckwheat	*Eriogonum humivagans*
Striped adobe lily	*Fritillaria striata*
Three-awn	*Aristida* spp.
Tobosa	*Hilaria mutica*
Tridens	*Tridens* spp.
Tulare pseudobahia	*Pseudobahia peirsonii*
Twist flower	*Streptanthus cordatus*
Western wheatgrass	*Agropyron smithii*
Wheatgrass	*Agropyron* spp.
Wild oat	*Avena* spp.
Zuni (or Rhizome) fleabane	*Erigeron rhizomatus*

APPENDIX E-2

COMMON AND SCIENTIFIC NAMES FOR WILDLIFE SPECIES

Common Name	Scientific Name
Birds	
American kestrel	Falco sparverius
Bald eagle	Haliaeetus leucocephalus
Baird's sparrow	Ammodramus bairdii
Barn swallow	Hirundo rustica
Bell's vireo	Vireo bellii
Black-billed magpie	Pica pica
Black phoebe	Sayornis nigricans
Black-tailed gnatcatcher	Polioptila melanura
Black-throated sparrow	Amphispiza bilineata
Blue-gray gnatcatcher	Polioptila caerulea
Brewer's sparrow	Spizella breweri
Brown-headed cowbird	Molothrus ater
Brown towhee	Pipilo fuscus
Burrowing owl	Athene cunicularia
Cactus wren	Campylorhynchus brunneicapillus
California quail	Callipepla californica
California condor	Gymnogyps californianus
Chukar	Alectoris chukar
Clark's nutcracker	Nucifraga columbiana
Common flicker	Colaptes auratus
Common nighthawk	Chordeiles minor
Common raven	Corvus corax
Cooper's hawk	Accipiter cooperi
Crissal thrasher	Toxostoma dorsale
Ferruginous hawk	Buteo regalis
Gambel's quail	Callipepla gambelii
Golden eagle	Aquila chrysaetos
Gray flycatcher	Empidonax wrightii
Great horned owl	Bubo virginianus
Green-tailed towhee	Pipilo chlorurus
Hairy woodpecker	Picoides villosus
Horned lark	Eremophila alpestris
Interior least tern	Sterna antillarum athalassos
Ladder-backed woodpecker	Picoides scalaris
LeConte's thrasher	Toxostoma lecontei
Lesser prairie chicken	Tympanuchus pallidicinctus
Loggerhead shrike	Lanius ludovicianus
Long-eared owl	Asio otus
McCown's longspur	Calcarius mccownii
Merriam's turkey	Meleagris gallopavo
Mountain chickadee	Parus gambeli

APPENDIX E-2 (continued)

COMMON AND SCIENTIFIC NAMES FOR WILDLIFE SPECIES

Common Name	Scientific Name
Mountain plover	Charadrius montanus
Mountain quail	Oreortyx pictus
Mourning dove	Zenaida macroura
Northern harrier	Circus cyaneus
Northern goshawk	Accipiter gentilis
Northern mockingbird	Mimus polyglottos
Peregrine falcon	Falco peregrinus
Pine grosbeak	Pinicola enucleator
Pine siskin	Spinus pinus
Pinyon jay	Gymnorhinus cyanocephalus
Prairie falcon	Falco mexicanus
Pygmy owl	Glaucidium gnoma
Red-tailed hawk	Buteo jamaicensis
Ring-necked pheasant	Phasianus colchicus
Roadrunner	Geococcyx californianus
Rock dove	Columba livia
Rock wren	Salpinctes obsoletus
Sage grouse	Centrocerus urophasianus
Sage sparrow	Amphispiza belli
Sage thrasher	Oreoscoptis montanus
Scaled quail	Callipepla squamata
Screech owl	Otis kennecottii
Sharp-shinned hawk	Accipiter striatus
Short-eared owl	Asio flammeus
Southern spotted owl	Strix occidentalis lucida
Swainson's hawk	Buteo swainsoni
Tricolored blackbird	Agelaius tricolor
Turkey vulture	Cathartes aura
Verdin	Auriparus flaviceps
Western meadowlark	Sturnella neglecta
Western yellow-billed cuckoo	Coccyzus americanus occidentalis
White-tailed (Mississippi) kite	Ictinia mississippiensis
White-winged dove	Zenaida asiatica
Whooping crane	Grus americana
Yuma clapper rail	Rallus longirostris yumanensis
Mammals	
Abert's squirrel	Sciurus aberti
Badger	Taxidea taxus
Big brown bat	Eptisicus fuscus
Black-footed ferret	Mustela nigripes

APPENDIX E-2 (continued)

COMMON AND SCIENTIFIC NAMES FOR WILDLIFE SPECIES

Common Name	Scientific Name
Blacktail jackrabbit	Lepus californicus
Bobcat	Lynx rufus
Cactus mouse	Peromyscus eremicus
Coyote	Canis latrans
Deer mouse	Peromyscus maniculatus
Desert bighorn sheep	Ovis canadensis mexicana
Desert cottontail	Sylvilagus audubonі
Desert kangaroo rat	Dipodomys deserti
Desert pocket mouse	Perognathus penicillatus
Desert shrew	Notiosorex crawfordi
Desert woodrat	Neotoma lepida
Elk	Cervus canadensis
Giant kangaroo rat	Dipodomys ingens
Golden-mantled ground squirrel	Spermophilus lateralis
Gray fox	Urocyon cinereoargenteus
Great Basin pocket mouse	Perognathus parvus
Gunnison's prairie dog	Cynomys gunnisoni
Hispid pocket mouse	Perognathus hispidus
Kit fox	Vulpes macrotis
Least chipmunk	Eutamias minimus
Little pocket mouse	Perognathus longimembris
Long-eared myotis	Myotis evotis
Longtail weasel	Mustela frenata
Merriam's kangaroo rat	Dipodomys merriami frenatus
Merriam's shrew	Sorex merriami
Mojave ground squirrel	Spermophilus mohavensis
Mule deer	Odocoileus hemionus
Nelson's antelope squirrel	Ammospermophilus nelsoni
Ord's kangaroo rat	Dipodomys ordii
Pallid bat	Antrazous pallidus
Pinyon mouse	Peromyscus trueii
Plains pocket mouse	Perognathus flavescens
Pronghorn antelope	Antilocapra americana
Red squirrel	Tamiasciurus hudsonicus
Rock pocket mouse	Perognathus intermedius
Rock squirrel	Spermophilus variegatus
San Joaquin pocket mouse	Perognathus inoratus inoratus
San Joaquin kit fox	Vulpes macrotis mutica
Short-nosed kangaroo rat	Dipodomys nitratoides brevinasus
Small-footed myotis	Myotis leibii
Southern grasshopper mouse	Onychomys torridus

APPENDIX E-2 (continued)

COMMON AND SCIENTIFIC NAMES FOR WILDLIFE SPECIES

Common Name	Scientific Name
Southern plains woodrat	Neotoma micropus
Spotted ground squirrel	Spermophilus spilosoma
Striped skunk	Mephitis mephitis
Swift fox	Vulpes velox
Tehachapi pocket mouse	Perognathus alticola inexpectatus
Tipton kangaroo rat	Dipodomys nitratoides nitratoides
Townsend's ground squirrel	Spermophilus townsendii
Vagrant shrew	Sorex vagrans
White-tailed antelope squirrel	Ammospermophilus leucurus
White-tailed jackrabbit	Lepus townsendii
White-tailed prairie dog	Cynomys gunnisoni
Wild burro	Equus asinus

Amphibians and Reptiles

Common Name	Scientific Name
Black-headed snake	Tantilla planiceps
Blunt-nosed leopard lizard	Gambelia silus
Brush lizard	Urosaurus graciosus graciosus
Coachwhip	Masticophis flagellum
Chihuahua whiptail lizard	Cnemidophorus exsanguis
Chuckwalla	Sauromalus obesus
Crevice spiney lizard	Sceloporus poinsetti
Desert horned lizard	Phrynosoma platyrhinos
Desert iguana	Dipsosaurus dorsalis
Desert short-horned lizard	Phrynosoma douglassi ornatissimum
Desert spiny lizard	Sceloporus magister
Desert tortoise	Gopherus agassizi
Dune sagebrush lizard	Sceloporus graciosus arenicolous
Eastern fence lizard	Sceloporus undulatus
Gila monster	Heloderma suspectum
Gopher snake	Pituophis melanoleucus
Ground snake	Sonora episcopa
Hopi rattlesnake	Crotalus viridis nuntius
Mohave rattlesnake	Crotalus scutulatus
Northern plateau lizard	Sceloporus undulatus elongatus
Rattlesnake	Crotalus spp.
Red coachwhip	Masticophis flagellum piceus

APPENDIX E-2 (continued)

COMMON AND SCIENTIFIC NAMES FOR WILDLIFE SPECIES

Common Name	Scientific Name
Sagebrush lizard	_Sceloporus graciosus_
Side-blotched lizard	_Uta stansburiana_
Sidewinder	_Crotalus cerastes_
Spotted whiptail lizard	_Cnemidophorus gularis_
Striped whipsnake	_Masticophis taeniatus_
Tehachapi slender salamander	_Batrachoseps stebbinsi_
Trans-Pecos rat snake	_Elaphe subocularis_
Tree lizard	_Urosaurus ornatus_
Western diamondback rattlesnake	_Crotalus atrox_
Western fence lizard	_Sceloporus occidentalis_
Western garter snake	_Thamnophis elegans_
Western patch-nosed snake	_Salvadora hexalepis_
Western whiptail	_Cnemidophorus tigris_
Western yellowbelly racer	_Coluber constrictor mormon_
Zebra-tailed lizard	_Callisaurus draconoides_

Invertebrates

Hopping's blister beetle	_Lytta nitidicollis_
Moestan's blister beetle	_Lytta moesta_
Moleston's blister beetle	_Lytta_ spp.
Morrison's blister beetle	_Lytta morrisoni_

VOLUME II

appendices

APPENDIX A

KERN RIVER PROPOSAL
CHARACTERISTICS OF THE SOIL MAPPING UNITS

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL

Milepost	Soil Mapping Unit	Soil Series	Slope (%)^{a}	Depth Class^{f}	Texture^{b}	Erosion Potential Water^{c}	Erosion Potential Wind^{d}	Reclamation Potential Limitations^{e}	Cropland
KERN MAINLINE									
Wyoming Basin and Middle Rocky Mountains									
0 - 9	Haterton-Teagulf-Westvaco Association: shallow and moderately deep, well drained, loamy soils; on undulating to hilly upland plains.	Haterton	5-30	S	Loam, clay loam	L-H	M	Poor: quantity	None
		Teagulf	5-20	MD	Sandy Loam	L-M	M	Fair: quantity	None
		Westvaco	5-20	MD	Sandy clay loam, clay loam	L-M	M	Poor: saline/alkaline	None
9-13 13.5-15 23.5-48.25 50.25-63.5	Blazon-Rickman-Pinelli Association: shallow to very deep, well drained, loamy and clayey soils; on gently sloping to very steep ridges, sideslopes and valleys.	Blazon	5-50	S	Loam, clay loam	L-VH	M	Poor: quantity	None
		Rickman	3-30	MD	Loam, clay loam	L-H	M	Fair: quantity	None
		Pinelli	3-30	VD	Clay loam, clay	L-H	M	Fair: clayey texture	None
13-13.5 15-23.5	Havre-Quealman Association: very deep, well drained, loamy soils; on nearly level floodplains.	Havre	0-3	VD	Loam	L	M	Good to Fair: sometimes saline/alkaline	None
		Quealman	0-3	VD	Fine sandy loam	L	M	Good to Fair: sometimes saline/alkaline	None
Middle Rocky Mountains									
48.25-50.25	Havre-Lassel-Bosler Association: very deep, well and somewhat poorly drained loamy and gravelly soils on nearly level to gently sloping floodplains, terraces, and fans.	Havre	0-6	VD	Loam	L	M	Good	Some
		Lassel	0-3	VD	Very fine sandy loam over sand and gravel	L	L	Fair: gravel and sand in lower part	Some
		Bosler	0-6	VD	Sandy loam and sandy clay loam over sand and gravel	L	M	Fair: gravel and sand in lower part	Some
63.5-66	Richsum-Econ Association: moderately deep and deep, well drained, loamy soils; on gently sloping to moderately steep hills and table lands.	Richsum	8-25	MD	Loam, clay loam	L-H	L	Fair: quantity	None
		Econ	8-25	D	Clay loam, silty clay loam	L-M	M	Fair: slope	None
66-70	Ant Flat-Hades-Picayune Family Association: deep and very deep, well drained, clayey and loamy soils; on sloping to steep foothills and mountains.	Ant Flat	10-40	D-VD	Clay, clay loam	M-VH	L	Fair: clayey texture	None
		Hades	10-40	D-VD	Loam, clay loam	M-H	L	Fair: slope	None
		Picayune	10-40	D-VD	Gravelly loam, gravelly clay loam	M-H	L	Fair: slope	None
70-79 87-89 90.5-91.5 94-96	Yeates Hollow-Manila-Henefer Association: deep and very deep, well drained, very gravelly and clayey soils; on moderately steep mountains and valley sideslopes.	Yeates Hollow	15-60	D	Very gravelly or very cobbly clay loam and clay	M-H	L	Fair to Poor: gravels,	None
		Manila	15-60	VD	Clay, clay loam	M-VH	L	Fair to Poor: clayey texture, slope	None
		Henefer	15-60	VD	Clay, clay loam, gravelly clay	M-VH	L	Fair to Poor: clayey texture, slope	None

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)^a	Depth Class^f	Texture^b	Erosion Potential Water^c	Erosion Potential Wind^d	Reclamation Potential Limitations^e	Cropland
79-87	Skutum-Lucky Star-Uinta Association: deep and very deep, clayey, very gravelly, and loamy soils; on sloping to very steep mountains.	Skutum	3-60	D	Gravelly clay and clay loam	L-VH	L	Fair to Poor: clayey texture, slope	None
		Lucky Star	3-60	VD	Very gravelly sandy loam and loam	L-H	L	Fair to Poor: gravels and cobbles, slope	None
		Uinta	3-60	VD	Gravelly clay loam and sandy clay loam	L-H	M	Good to Poor: slope	None
89-90.5 91.5-94.0 96-100	Kovich-Moweba-Manila Association: very deep, loamy, very gravelly and clayey soils; on nearly level to sloping valley floors, alluvial fans, and fan terraces.	Kovich	0-2	VD	Loam over very gravelly sand	L	L	Fair: gravels and sand in substratum	Some
		Moweba	1-10	VD	Very gravelly loam	L	L	Fair: gravels	Some
		Manila	1-10	VD	Clay, clay loam	L-M	L	Fair: clayey texture	Some
100-102	Broadhead-Littlepole Association: very deep and shallow, well drained, clayey and very cobbly soils; on sloping to steep mountains and foothills.	Broadhead	6-40	D	Clay, clay loam	L-H	L	Fair: clayey texture	None
		Littlepole	25-40	S	Very cobbly sandy clay loam	L-M	L	Poor: quantity, cobbles	None
102-118 121.2-122.7	Clayburn-Flygare-Baird Hollow Association: deep well drained, loam and very cobbly soils; on sloping to steep high mountains and plateaus.	Clayburn	6-40	D	Loam, sandy clay loam	L-H	L	Fair to Poor: slope	None
		Flygare	6-40	D	Very cobbly loam	L-H	L	Fair to Poor: cobbles	None
		Baird Hollow	6-40	D	Very cobbly clay loam, very cobbly clay	L-H	L	Fair to Poor: cobbles	None
118-121.2 122.7-123	Borolls-Aquolls Association: very deep, moderately well to poorly drained, loamy and gravelly soils on nearly level to gently sloping bottomlands.	Borolls	0-5	VD	Loamy and very gravelly	L	L	Fair: gravels	None
		Aquolls	0-5	VD	Loamy and very gravelly	L	L	Fair: gravels	None
123-146	Borolls-Xerolls-Orthents Association: very deep and shallow, well drained, very gravelly and loamy soils; on moderately steep to very steep mountains.	Borolls-Xerolls, gravelly	15-70	VD	Very gravelly and cobbly, sandy loam and loam	M-VH	L	Fair to Poor: gravels, cobbles, slope	None
		Borolls-Xerolls, loamy	15-70	VD	Loam to silty clay loam	M-VH	L	Fair to Poor: slope	None
		Borolls-Orthents shallow	15-70	S	Very gravelly and cobbly sandy loam and loam	M-VH	L	Poor: quantity, slope	None
146-149	Birdow-Manila Association: very deep, well drained, loamy and clayey soils; on gently sloping to sloping floodplains and fans.	Birdow	2-4	VD	Very fine sandy loam to clay loam	L	M	Good	Some
		Manila	2-10	VD	Clay, clay loam	L-M	L	Fair: clayey texture	Some

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
149-161	Obrast-Bezzant-Bagard Association: very deep, well drained, clayey and very cobbly or stony soils; on mountain foot slopes and alluvial fans.	Obrast	4-40	VD	Clay, silty clay loam	L-H	M	Fair to Poor: clayey texture	Some
		Bezzant	4-40	VD	Gravelly loam, very cobbly or very stony loam and sandy loam	L-H	L	Fair to Poor: cobbles and stones	Some
		Bagard	4-40	VD	Very cobbly clay or clay loam	L-H	L	Fair to Poor: cobbles, clayey texture	Some
161-168	Deer Creek-Yeates Hollow-Wallsburg Association: very deep and shallow, well drained, clayey and very cobbly soils; on sloping to steep mountains and foothills.	Deer Creek	6-40	VD	Cobbly and stony clay and clay loam	L-H	L	Fair to Poor: cobbles, stones, clayey texture	None
		Yeates Hollow	20-40	VD	Very cobbly clay	M-H	L	Fair to Poor: cobbles, clayey texture	None
		Wallsburg	20-40	S	Very cobbly clay	M-H	L	Poor: quantity, clayey texture	None
168-175.5	Agassiz-Sheep Creek-Rock Outcrop Association: shallow and moderately deep, well drained, very gravelly and stony soils and rock outcrop; on sloping to very steep mountains.	Agassiz	30-70	S	Very stony or extremely stony loam	H-VH	L	Poor: quantity, cobbles slope	None
		Sheep Creek	10-30	MD	Very cobbly clay loam, very gravelly sandy loam	M-H	L	Fair to Poor: gravels and cobbles, quantity	None
		Rock Outcrop	-	-	---	-	-	-----	--
175.5-180	Rofiss-Haploxerolls Association: very deep, well drained, loamy and very gravelly soils; on sloping alluvial fans and terraces.	Rofiss	4-15	VD	Very gravelly clay loam	L-M	L	Fair: gravels	None
		Haploxerolls	4-15	VD	Loam, gravelly loam	L-M	L	Good to Fair: gravels	None
180-185	Manila-Yeates Hollow-Xeric Torriorthents Association: shallow to very deep, well drained, clayey and extremely stony soils; on sloping to steep foothills and alluvial fans	Manila	4-8	VD	Clay, clay loam	L-M	L	Fair: clayey texture	None
		Yeates Hollow	6-25	VD	Extremely stony clay or clay loam	L-M	L	Fair to Poor: stones	None
		Xeric Torriorthents	30-70	S-MD	Shaley loam to silty clay	M-VH	L	Poor: slope, quantity	None
Basin and Range									
185-197.5	Juab-Nephi Association: very deep, well drained, loamy soils; on nearly level to sloping fans and lake terraces.	Juab	0-8	VD	Loam, silt loam	L	M	Good: none	Some
		Nephi	0-8	VD	Silt loam, silty	L	M	Good: none	Some
197.5-199	Amtuft-Rock Outcrop Association: shallow, well drained, very gravelly or very cobbly soils and rock outcrop; on steep hills and ridges.	Amtuft	30-70	S	Very gravelly or very cobbly loam or sandy loam	H-VH	L	Poor: quantity, slope, gravels	None
		Rock Outcrop	_	_	_ _	_	_	_ _ _ _	_ _

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential		Reclamation Potential Limitations[e]	Cropland
						Water[c]	Wind[d]		
199-202.5	Genola Association: very deep, well drained, loamy soils; on gently sloping lake terraces and fans.	Genola	1-5	VD	Silt loam, silty clay loam	L	M	Good	None
202.5-203.5	Mellor Association: very deep, somewhat poorly to well drained, saline and alkaline, loamy soils; on nearly level floodplains and low terraces.	Mellor	0-2	VD	Silt loam, fine sandy loam	L	M	Fair to Poor: saline and alkaline	None
203.5-218.5	Shabliss-Pober-Genola Association: shallow to very deep, well drained, loamy and very gravelly soils; on fans and lake terraces.	Shabliss	1-5	S	Loam, fine sandy loam over a hardpan	L	L	Poor: quantity	None
		Pober	2-30	MD	Very gravelly loam or sandy loam over a hardpan	L-H	M	Fair: gravels, quantity	None
		Genola	1-5	D	Silt loam, silty clay loam	L	M	Good	Some
218.5-220.5 234.2-234.7	Reywat-Wallsburg Association: shallow, well drained, very cobbly soils; on steep mountains.	Reywat	25-60	S	Very cobbly clay loam	H-VH	L	Poor: quantity, cobbles	None
		Wallsburg	25-60	S	Very cobbly clay	M-VH	L	Poor: quantity, cobbles	None
220.5-234.2	Ebbs-Pavant Association: very deep and shallow, well drained, loamy soils; on fans.	Ebbs	0-5	VD	Loam, silt loam	L	M	Good	Some
		Pavant	2-5	S	Loam, clay loam	L	M	Poor: quantity	Some
234.7-240	Ebbs Association: very deep, well drained, loamy soils; on fans.	Ebbs	0-5	VD	Loam, silt loam	L	M	Good	Some
240-255.5	Kanosh-Woodrow-Hardy Association: very deep to moderately deep, somewhat poorly and well drained soils; on nearly level low lake terraces.	Kanosh	0-2	VD	Loam, fine sandy loam	L	M	Fair to Poor: saline/alkaline	Some
		Woodrow	0-2	VD	Silty clay loam	L	M	Good to Fair: saline/alkaline	Some
		Hardy	0-2	MD	Loam over a hardpan	L	M	Fair: quantity	Some
255.5-263 266.5-274.5	Kessler-Penoyer-Hiko Peak Association: very deep, well drained, loamy and very gravelly soils, on gently sloping to moderately steep fans, valleys and hills.	Kessler	1-20	VD	Silt loam, loam	L-M	M	Fair: salinity/alkalinity in lower part	Some
		Penoyer	1-10	VD	Silt loam, loam	L-M	M	Fair: salinity/alkalinity in lower part	Some
		Hiko Peak	1-20	VD	Gravelly or very gravelly loam or sandy loam	L-M	L	Fair: gravels	Some
263-266.5	Mill Hollow-Ushar-Pharo Association: very deep, well drained, loamy and very gravelly soils; on sloping to moderately steep fans, terraces and hills	Mill Hollow	3-20	VD	Loam or silt loam	L-M	L	Good to Fair: slope	None
		Ushar	3-20	VD	Loam or clay loam	L-M	M	Good to Fair: slope	None
		Pharo	3-20	VD	Very gravelly sandy loam to silt loam	L-M	L	Fair: gravels	None

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
274.5-276.5 277.5-284	Snake Hollow-Blackett-Blue Star Association: very deep, well drained, loamy and gravelly soils; on gently sloping to moderately steep fans.	Snake Hollow	1-20	VD	Sandy loam over gravel and sand	L-M	M	Fair: gravel and sand in lower part	None
		Blackett	1-20	VD	Coarse sandy loam, loam	L-M	M	Fair: sandy texture	None
		Blue Star	1-20	VD	Gravelly coarse sandy loam	L-M	M	Fair: sandy texture	None
276.5-277.5	Rock Land-Bearskin-Cowers Association: shallow to deep, well drained, loamy soils and rock outcrop; on steep mountains.	Rock Land	-	-	----	-	-	----	--
		Bearskin	20-60	S	Gravelly sandy clay loam	M-VH	M	Poor: quantity, slope	None
		Cowers	20-60	VD	Loam, gravelly sandy loam	M-VH	M	Fair to Poor: slope	None
284-298	Hiko Peak-Decca-Sheeprock Association: very deep, well drained, loamy and gravelly soils, on fans.	Hiko Peak	1-15	VD	Gravelly or very gravelly loam or sandy loam	L-M	L	Fair: gravels	None
		Decca	1-15	VD	Sandy clay loam over very gravelly sandy loam and sand	L-M	L	Fair: gravels	None
		Sheeprock	1-15	VD	Very gravelly sand	L-M	L	Poor: gravel and sand	None
298-309 317-322	Manselo-Unius-Taylorsflat Association: shallow and very deep, well drained, loamy soils; on fans and plains.	Manselo	0-15	VD	Loam, sandy loam	L-M	M	Good	None
		Unius	0-15	VD	Sandy loam over cemented layers, sand, and gravel	L	L	Poor: quantity, sand and gravel	None
		Taylorsflat	0-5	VD	Sandy loam to clay loam	L	M	Good to Fair: sometimes saline/alkaline in lower part	None
309-317	Ocambee-Pavant-Red Butte Association: shallow and very deep, well drained, loamy and gravelly soils; on sloping to steep mountains and fans.	Ocambee	4-40	MD	Very gravelly clay loam	L-H	L	Fair: quantity, gravels	None
		Pavant	2-35	S	Gravelly loam or clay loam	L-H	L	Poor: quantity	None
		Red Butte	2-40	VD	Very gravelly clay loam	L-H	L	Fair: gravels	None
322-342	Antelope Springs-Manselo-Uvada Association: very deep, well drained, saline and alkaline, loamy and clayey soils; on nearly level alluvial plains.	Antelope Springs	0-2	VD	Clay loam, loam	L	M	Fair to Poor: saline/alkaline	None
		Manselo	0-3	VD	Loam, sandy clay loam	L	M	Fair: saline/alkaline, cemented layer	None
		Uvada	0-2	VD	Silty clay, silty clay loam	L	M	Poor: saline/alkaine	None
342-361	Sevy-Taylorsflat-Lucero Association: very deep, well drained, loamy soils; on fans.	Sevy	1-10	VD	Clay loam, loam	L	L	Good	None
		Taylorsflat	1-5	VD	Sandy loam to clay loam	L	M	Good to Fair: sometimes saline/alkaline in lower part	None
		Lucero	4-20	VD	Gravelly and cobbly loam and clay loam	L-M	L	Fair: gravels and cobbles	None

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

						Erosion Potential			
Milepost	Soil Mapping Unit	Soil Series	Slope (%)^a	Depth Class^f	Texture^b	Water^c	Wind^d	Reclamation Potential Limitations^e	Cropland
361-368	Argiborolls-Argiustolls Association: deep and moderately deep, well drained, loamy and clayey soils; on sloping to moderately steep benchlands, hillslopes and fans.	Argiborolls, deep	3-30	D	Loam, clay loam, clay	L-H	L	Good to Fair: slope	None
		Argiustolls-Argiborolls, moderately deep	3-30	MD	Loam, clay loam, clay	L-H	L	Fair: quantity	None
368-372	Argiborolls-Argiustolls Association: shallow to deep, well drained, very gravelly and cobbly, and clayey soils; on moderately steep to steep hillslopes.	Argiborolls, shallow	10-40	S	Gravelly or very gravelly clay loam	M-H	L	Poor: quantity	None
		Argiborolls, moderately deep	10-40	MD	Very gravelly clay loam	M-H	L	Fair to Poor: quantity gravels, slope	None
		Argiustolls, deep	10-40	D	Cobbly clay loam	M-H	L	Fair to Poor: cobbles, slope	None
372-377.5	Ustorthents-Haplargids Association: moderately deep and deep, well drained, very gravelly soils; on moderately steep to steep dissected foothills.	Ustorthents, moderately deep	10-40	MD	Very gravelly clay loam and loam	M-H	L	Fair to Poor: quantity, gravels, slope	None
		Haplargids, deep	10-40	D	Very gravelly clay loam	M-H	L	Fair to Poor: gravels, slope	None
377.5-390	Curhollow-Pastura-Rock Land Association: shallow, well drained, gravelly soils, rockland, and badland; on gently sloping to steep mesas and dissected uplands.	Curhollow	2-30	S	Very gravelly fine sandy loam over a hardpan	L-M	L	Poor: quantity	None
		Pastura	2-30	S	Gravelly loam or clay loam over a hardpan	L-M	L	Poor: quantity	None
		Rock Land-Badland	2-60	-	----	-	-	----	--
Mojave Desert									
390-410	Cave Association: shallow, well drained, loamy soils; on sloping to moderately steep fans.	Cave	2-30	S	Gravelly sandy loam over a hardpan	L-M	M	Poor: quantity	None
410-423	Mormon Mesa-Muddy Creek Association: shallow, well drained, loamy soils; on sloping to steep dissected pediments	Mormon Mesa	2-8	S	Fine sandy loam over a hardpan	L	M-H	Poor: quantity	None
		Muddy Creek	15-50	S	Gravelly fine sandy loam	M-H	M	Poor: quantity, slope	None
423-443.5	Mormon Mesa-Flattop-Arada Association: shallow and very deep, well and somewhat excessively drained, loamy and very gravelly soils; on nearly level to sloping fans and terraces.	Mormon Mesa	0-8	S	Fine sandy loam	L	M-H	Poor: quantity	None
		Flattop	2-8	MD	Gravelly and very gravelly fine sandy loam over cemented layers	L	L	Fair: quantity, gravels	None
		Arada	0-8	VD	Sand, very gravelly loamy sand	L	H	Poor: sandy texture	None

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
443.5-446.5 447-449 487-492	Badland-Rock Land-St. Thomas Association: shallow, well drained, very cobbly soils, badland and rockland, on sloping to steep foothills and mountains.	Badland-Rock Land	-	-	----	-	-	----	--
		St. Thomas	10-50	S	Very cobbly loam	M-H	L	Poor: quantity, slope	None
446.5-447	Calico Association: very deep, somewhat poorly drained, loamy soils; on nearly level bottomlands.	Calico	0-2	VD	Stratified sandy loam to silty clay over sand	L	M	Good to Fair: sandy substratum, saline/alkaline	Some
449-482	Bard-Tonapah Association: shallow and deep, well and somewhat excessively drained, loamy and very gravelly soils; on fans and terraces.	Bard	2-15	S	Fine sandy loam over a hardpan	L-M	M	Poor: quantity	None
		Tonapah	2-15	VD	Very gravelly sand	L	L	Poor: gravel and sand	None
482-487	Aztec-Bracken Association: very deep and deep, well and somewhat excessively drained, loamy gypsiferous soils; on dissected pediments and fans.	Aztec	4-15	VD	Gravelly sandy loam and extremely gravelly loamy sand	L	L	Fair to Poor: gypsum gravels	None
		Bracken	8-30	D	Gypsiferous sandy loam	L-M	L	Fair to Poor: gypsum	None
492-494 495-502	Caliza-Aztec Association: very deep, well drained, very gravelly soils; on sloping fan terraces.	Caliza	0-8	VD	Very gravelly loamy coarse sand	L	L	Poor: gravel and sand	None
		Aztec	0-8	VD	Very gravelly sandy loam and extremely gravelly loamy sand	L	L	Fair to Poor: gypsum, gravels	None
494-495	Land-Glencarb Association: very deep, well drained, well and somewhat poorly drained; saline/alkaline, loamy soils; on nearly level alluvial flats and floodplains.	Land	0-2	VD	Silty clay loam	L	L	Poor: saline/alkaline	None
		Glencarb	0-2	VD	Stratified very fine sandy loam to silty clay loam	L	L	Fair: saline/alkaline	None
502-515	Cave-Las Vegas-Goodsprings Association: shallow, well drained, gravelly and loamy soils; on nearly level to strongly sloping fan remnants.	Cave	0-15	S	Gravelly sandy loam over a hardpan	L-M	M	Poor: quantity	None
		Las Vegas	0-15	S	Fine sandy loam, gravelly sandy clay loam over a hardpan	L-M	M	Poor: quantity	None
		Goodsprings	0-15	S	Gravelly fine sandy loam over a hardpan	L-M	M	Poor: quantity	None

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential		Reclamation Potential Limitations[e]	Cropland
						Water[c]	Wind[d]		
515-534 534.5-542 546.5-566 566.5-580.2 580.7-581.2 581.7-590 591.5-595 596-610	Ivanpah Valley, Nevada and Northeastern Mojave Desert, Alluvial Soils: very deep and shallow, well and somewhat excessively drained, very gravelly, sandy and loamy soils; on nearly level to moderately steep fans and terraces.	Nickel	2-15	VD	Very gravelly sandy loam	L	L	Fair: gravels	None
		Arizo	0-15	VD	Very gravelly loamy sand	L	L	Poor: gravels and sand	None
		Cajon	0-5	VD	Gravelly loamy sand	L	H	Poor: sandy texture	None
		Cave	0-15	S	Gravelly sandy loam over a hardpan	L-M	M	Poor: quantity	None
		Grapevine	0-5	VD	Sandy loam, gravelly sandy loam	L	M	Good to Fair: saline/alkaline	None
534-534.5 542-546.5 566-566.5 580.2-580.7 581.2-581.7 590-591.5 595-596 610-611	Ivanpah Valley, Nevgada and Northeastern Mojave Desert, Hill and Mountain soils: shallow, well drained, loamy and very gravelly soils, and rock outcrop; on sloping to steep foothills and mountains.	Tecopa	15-60	S	Very gravelly sandy loam	M-H	L	Poor: quantity, slope gravels	None
		Sparkhule	15-60	S	Sandy loam, sandy clay loam	M-VH	L	Poor: quantity, slope	None
		Rock Outcrop	-	-	----	-	-	----	--
611-675	Mojave Desert, Barstow Area: very deep, somewhat excessively to moderately well drained, sandy and loamy soils; on nearly level to sloping fans, terraces, and plains.	Cajon	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
		Manet	0-9	VD	Sand, loamy sand	L	H	Poor: sandy texture	None
		Halloran	0-2	VD	Loamy sand, sandy loam	L	H	Poor: saline/alkaline	None
		Norob	0-5	VD	Sandy clay loam	L	M	Poor: saline/alkaline	None
675-684 689-689.5	Norob-Uralia Association: very deep and deep, nearly level and gently sloping, well drained soils on alluvial fans and plains.	Norob	0-5	VD	Sandy clay loam	L	M	Poor: saline/alkaline	None
		Neuralia	2-5	D	Sandy loam, sandy clay loam	L	M	Good: none	None
684-689	Cajon-Arizo-Alko Association: very deep and shallow, nearly level to strongly sloping, well drained and exsessively drained soils on alluvial fans, alluvial plains and old terraces	Cajon	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
		Arizo	2-9	VD	Gravelly loamy sand	L	H	Poor: gravelly and sandy texture	None
		Alko	0-9	S	Sandy loam over a hardpan	L	M	Poor: quantity	None
689.5-691.5 699-706 711-713.5	Garlock-Neuralia Association: very deep and deep, nearly level to moderately sloping, well drained soils on old stream terraces, alluvial fans, and alluvial plains	Garlock	2-9	VD	Loamy sand to sandy clay loam	L	H	Fair: sandy texture	None
		Neuralia	2-5	VD	Sandy loam, sandy clay loam	L	M	Good: none	None
691.5-699	Randsburg-Murdock Association: shallow, gently sloping to strongly sloping, well drained soils on low pediments.	Randsburg	2-15	S	Sandy loam	L-M	M	Poor: quantity	None
		Murdock	2-9	S	Sandy loam over a hardpan	L	M	Poor: quantity	None

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential		Reclamation Potential Limitations[e]	Cropland
						Water[c]	Wind[d]		
706-707	Rosamond-DeStazo Association: very deep, nearly level to moderately sloping, well drained soils; on floodplains and in basins.	Rosamond	5-15	VD	Clay loam, loam	L-M	M	Good to Poor: sometimes saline/alkaline	None
		DeStazo	0-2	VD	Sandy loam to clay loam	L	M	Fair to Poor: gravels, high line	None
707-711	Cajon: very deep, nearly level to strongly sloping, somewhat excessively drained soils on alluvial fans and plains	Cajon	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
Tehachapi Mountains									
713.5-718	Pajuela-Whitewolf: very deep, nearly level to steep, somewhat excessively drained soils on old stream terraces, alluvial fans and floodplains.	Pajuela	30-50	D	Gravelly loamy sand	H-VH	M	Poor: gravelly texture, slope	None
		Whitewolf	0-5	VD	Loamy sand	L	H	Poor: sandy texture	None
718-721 729-729.75 730.5-732 734-741	Walong-Anaverde-Edmundston: very deep to moderately deep, hilly to very steep, well drained soils underlain by weathered granite or schist; on mountainous uplands.	Walong	15-30	MD	Sandy loam	M-H	M	Fair: slope quantity	None
		Anaverde	30-75	VD	Gravelly loam	H-VH	M	Poor: slope	None
		Edmundston	30-75	D	Gravelly sandy loam	H-VH	M	Poor: slope	None
721-729 729.75-730.5 732-734 741-742 743.6-746	Steuber-Tehachapi-Havala: very deep, nearly level to hilly, well drained soils on alluvial fans, stream floodplains, and terraces of the mountain valleys.	Steuber	2-9	D	Stony sandy loam, sandy loam	L	M	Good to Fair: stones	Some
		Tehachapi	2-30	D	Loam, sandy loam	L-H	L	Good to Fair: slope	Some
		Havala	0-15	VD	Sandy loam	L-M	M	Good: none	Some
746-747	Chanac-Pleito-Badlands: very deep, gently sloping to steep, well drained soils on old dissected terraces; and badlands.	Chanac	5-50	VD	Sandy clay loam, sandy loam	L-VH	L	Good to Poor: slope	None
		Pleito	2-50	VD	Sandy clay loam, gravelly sandy clay loam	L-VH	L	Good to Poor: slope	None
		Badlands	30-75	-	----	-	-	----	--
San Joaquin Valley									
742-743.5 747-753	Hesperia-Arvin-Whitewolf: very deep, nearly level to moderately sloping, well drained and somewhat excessively drained soils on alluvial fans, floodplains and stream terraces.	Hesperia	0-9	D-VD	Sandy loam	L-M	M	Good: none	Some
		Arvin	2-9	D	Sandy loam	L-M	M	Good: none	Some
		Whitewolf	0-5	D-VD	Loamy sand	L	H	Poor: sandy texture	Some
753-756.1	San Emigdio-Hesperia Association: deep to very deep, well drained, coarse textured soils developing in alluvium on fans.	San Emigdio	2-5	VD	Fine sandy loam	L	M	Good: none	Some
		Hesperia	2-5	D-VD	Sandy loam	L	M	Good: none	Some

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
KERN RIVER LATERAL									
San Joaquin Valley									
0-1.3 8.5-9.5	San Emigdio-Hesperia Association: deep to very deep, well drained, coarse textured soils developing in alluvium on fans.	San Emigdio	2-5	D	Fine sandy loam	L	M	Good: none	Some
		Hesperia	2-5	D-VD	Sandy loam	L	M	Good: none	Some
1.3-4 9.5-10.5	Cajon-Tujunga Association: deep, somewhat excessively drained coarse textured soils developing in granitic alluvium.	Cajon	0-5	D	Loamy sand	L	H	Poor: sandy texture	Some
		Tujunga	2-5	D	Loamy sand	L	M	Poor: sandy texture	Some
4-4.5 5-6.5 7.5-8.5	Grangeville-Hesperia Association, saline-alkali: deep, moderately well to somewhat excessively drained, coarse textured soils on fans.	Grangeville	0-5	D	Sandy loam	L	M	Fair: sometimes saline/ alkaline	Some
		Hesperia	0-5	D	Sandy loam	L	M	Fair: sometimes saline/ alkaline	Some
4.5-5 6.5-7.5	Merced-Rossi Association, saline-alkali: deep and very deep, somewhat poorly drained, clayey and loamy alluvial soils.	Merced	0-5	VD	Clay	L	L	Fair to Poor: clayey texture, saline/alkaline	Some
		Rossi	0-5	D	Clay loam	L	L	Fair to Poor: saline/ alkaline	Some
10.5-15	Kimberlina Association: deep to very deep, well drained soils forming in alluvium on fans and plains.	Kimberlina	0-5	D-VD	Sandy loam, gravelly sandy loam	L	L	Good: none	Some
15-19.5 21-22	Delano Association: very deep, nearly level to sloping, well drained soils; on fans and terraces.	Delano	0-9	VD	Clay loam	L-M	L	Good: none	Some
19.5-21 22-23.7	Xeric Torriorthents, stratified-Cuyama complex: deep and very deep, well drained, gravelly and loamy soils on dissected uplands.	Xeric Torriorthents	9-50	D	Gravelly loamy texture	L-VH	L	Fair to Poor: gravelly slope	None
		Cuyama	9-15	VD	Gravelly clay loam	L-M	M	Fair to Poor: slopes gravel	None
23.7-24.2	Excelsior Variant-Cajon-Riverwash Association: very deep, loamy and sandy soils on bottomlands, terraces and fans.	Excelsior Variant	0-3	VD	Stratified sand to silt loam	L	L	Fair: sandy texture	Some
		Cajon	0-3	VD	Loamy sand	L	H	Poor: sandy texture	Some
		Riverwash	0-3	VD	----	-	-	----	--
24.2-27.0	Elkhills-Torriorthents, stratified complex: deep, well drained soils forming in alluvium on dissected uplands.	Elkhills	9-50	VD	Sandy loam	M-VH	L	Good to Poor: slope	None
		Torriorthents	9-50	D-VD	Very gravelly sandy loam	M-VH	L	Fair to Poor: gravels. slope	None

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
TAFT LATERAL									
San Joaquin Valley									
0-28 32-39	San Emigdio-Hesperia Association: deep to very deep, well drained, coarse textured soils developing in alluvium on fans.	San Emigdio	2-5	VD	Fine sandy loam	L	M	Good: none	Some
		Hesperia	2-5	D-VD	Sandy loam	L	M	Good: none	Some
28-32	Kettlemen Association: moderately deep, well drained, medium textured soils developing in weathered sedimentary rock of hilly to mountainous areas.	Kettleman	15-50	MD	Loam	M-VH	L	Fair to Poor: quantity, slope	None
39-46	Kimberlina Association: deep to very deep, well drained soil forming in alluvium on fans and plains.	Kimberlina	0-5	D-VD	Sandy loam, gravelly sandy loam	L	L	Good: none	Some
46-48.0	Elkhills-Torriorthents, stratified complex: deep, well drained soils forming in alluvium on dissected uplands.	Elkhills	9-50	VD	Sandy loam	M-VH	M	Good to Poor: slope	None
		Torriorthents	9-50	VD	Very gravelly sandy loam	M-VH	M	Fair to Poor: gravelly texture, slope	None
WASATCH VARIATION									
Middle Rocky Mountains									
0-5	Yeates Hollow-Manila-Henefer Association: deep and very deep, well drained, very gravelly and clayey soils; on moderately steep to steep mountains and valley sideslopes.	Yeates Hollow	15-60	D	Very gravelly or very cobbly clay loam and clay	M-H	L	Fair to Poor: gravels, cobbles, clayey texture, slope	None
		Manila	15-60	VD	Clay, clay loam	M-VH	L	Fair to Poor: clayey texture, slope	None
		Henefer	15-60	VD	Clay, clay loam, gravelly clay	M-VH	L	Fair to Poor: clayey texture, slope	None
5-14 16-23	Richsum-Cutoff Family-Vicking Association: moderately deep and deep, well drained, loamy and very gravelly soils; on sloping to to steep mountains and valley sideslopes.	Richsum	15-70	MD	Loam, clay loam	M-VH	L	Fair to Poor: quantity, slope	None
		Cutoff Family	15-70	D	Very gravelly sandy loam and loam	M-VH	L	Fair to Poor: slope	None
		Vicking	10-40	VD	Clay loam, loam	M-H	L	Fair to Poor: slope	Some
14-16	Sowcan-Pringle-Watkins Ridge Association: very deep, somewhat poorly to well drained, loamy and very gravelly soils; on nearly level to sloping bottomlands and alluvial fans.	Sowcan	0-5	VD	Loam, fine sandy loam over very gravelly sand	L	M	Fair: very gravelly sand substratum	Some
		Pringle	0-5	VD	Stratified loamy over sand and gravel	L	L	Fair: sand and gravel substratum	Some
		Watkins Ridge	0-10	VD	Loam, clay loam	L	M	Good	Some

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)^a	Depth Class^f	Texture^b	Erosion Potential Water^c	Erosion Potential Wind^d	Reclamation Potential Limitations^e	Cropland
23-26 30.5-32.5	Bertag-Donner-Yeates Hollow Association: deep and very deep, well drained, clayey and cobbly soils; on sloping to steep foothills and mountain footslopes.	Bertag	10-40	VD	Silty clay loam, clay loam, clay	M-H	L	Fair to Poor: clayey texture, slope	None
		Donner	10-40	MD	Clay loam, silty clay	M-H	L	Fair to Poor: clayey texture, slope	None
		Yeates Hollow	6-50	D	Cobbly and very cobbly clay loam and clay	L-H	L	Fair to Poor: cobbles, slope	None
26-29	Henoit-Kilfoil Association: very deep and moderately deep, well drained, very gravelly and loamy soils; on very steep mountain slopes and canyon walls.	Henoit	30-60	VD	Very gravelly clay loam	H-VH	L	Poor: slope, gravels	None
		Kilfoil	40-60	MD	Clay loam, gravelly loam	H-VH	L	Poor: slope	None
29-30.5	Eastcan Association: very deep, moderately well drained, loamy soils, on nearly level to gently sloping valley bottoms,	Eastcan	0-5	VD	Loam, silt loam	L	L	Good	None
32.5-35	Etchen-Henoit Association: moderately deep and very deep, well drained, very gravelly and cobbly soils; on very steep mountains and canyon walls.	Etchen	30-60	MD	Cobbly and very cobbly sandy clay loam	H-VH	L	Poor: slope, gravels and cobbles	None
		Henoit	30-60	VD	Very gravelly clay loam	H-VH	L	Poor: slope, gravels and cobbles	None
35-38.5	Lucky Star-Charcol Association: very deep, well drained, very gravelly soils; on steep mountains.	Lucky Star	30-60	VD	Very gravelly or very cobbly loam and sandy loam	H-VH	L	Poor: slope, gravels and cobbles	None
		Charcol	30-60	VD	Very gravelly or very cobbly loamy fine sand to clay loam	M-H	L	Poor: slope, gravels and cobbles	None
38.5-48.5	Ridd-Rock Outcrop-Kilburn Association: moderately deep and very deep, loamy and very gravelly soils, and rock outcrop, on sloping to steep mountains, canyon walls, and associated fans and terraces on toeslopes.	Ridd	30-70	MD	Gravelly or very gravelly sand loam	H-VH	L	Poor: slope, gravels	None
		Rock Outcrop	-	-	----	-	-	----	--
		Kilburn	10-50	VD	Gravelly or cobbly sandy loam over very gravelly loamy sand	M-H	L	Fair to Poor: very gravelly substratum, slope	None
Basin and Range									
48.5-51	Chipman Association: very deep, poorly drained, loamy soils, on nearly level floodplains.	Chipman	0-3	VD	Silty clay loam	L	M	Good to Fair: sometimes saline/alkaline	Some
51-61	Decker-Lasil-Saltair Association: very deep, somewhat poorly and poorly drained, saline/alkaline, loamy soils; on nearly level lake plains.	Decker	0-2	VD	Stratified sandy loam to silty clay loam	L	M	Fair to Poor: saline/alkaline	None
		Lasil	0-2	VD	Silty clay loam	L	M	Poor: saline/alkaline	None
		Saltair	0-2	VD	Silty clay loam	L	L	Poor: saline/alkaline	None

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential		Reclamation Potential Limitations[e]	Cropland
						Water[c]	Wind[d]		
61-79	Bingham-Hans Association: very deep, well drained, loamy and gravelly soils; on nearly level to sloping lake plains and fans.	Bingham	0-10	VD	Gravelly or cobbly loam and clay loam over very cobbly loamy sand	L	L	Fair: very cobbly and sandy substream	Some
		Hans	0-6	VD	Silty clay loam and silt loam	L	L	Good: none	Some
79-88	Dry Creek-Juab-Lodar Association: very deep and shallow, well drained, clayey, loamy and very gravelly soils; on gently sloping to steep fans, terraces, and hills.	Dry Creek	4-15	VD	Gravelly or cobbly clay	L-M	L	Fair: clay, gravels and cobbles	None
		Juab	0-8	VD	Loam, silt loam	L	M	Good: none	Some
		Lodar	10-50	S	Very gravelly to very stony loamy	M-VH	l	Poor: quantity, gravels, cobbles, and stones	None
88-89.5 100.5-103 125.5-128 130-132 141-142	Amtuft-Borvant-Reywat Association: shallow, well and somewhat excessively drained, very gravelly and cobbly soils; on sloping to steep hills and mountains.	Amtuft	8-60	S	Very cobbly and very gravelly loam and sandy loam	M-VH	L	Poor: quantity, gravels and cobbles, slope	None
		Borvant	8-60	S	Very gravelly loam over a hardpan	M-VH	L	Poor: quantity, gravels, and cobbles, slope	None
		Reywat	8-60	S	Very cobbly clay loam	M-VH	L	Poor: quantity, gravels and cobbles, slope	None
89.5-100.5 103-125.5 128-130 142-148.5	Genola-Linoyer-Donnardo Association: very deep, well drained, loamy and very cobbly soils; on nearly level to sloping fans and terraces.	Genola	0-10	VD	Silt loam	L-M	M	Good: none	None
		Linoyer	0-10	VD	Very fine sandy loam and silt loam	L-M	M	Good: none	None
		Donnardo	2-10	VD	Very cobbly loam or fine sandy loam	L	L	Poor: cobbles and gravel	None
132-141	Juab-Hansel Association: very deep, well drained, very deep, loamy soils; on nearly level to sloping fans and terraces.	Juab	0-8	VD	Loam or silt loam	L	M	Good: none	Some
		Hansel	0-8	VD	Silt loam	L	L	Good: none	Some
148.5-150	Mellor Association: very deep, somewhat poorly to well drained, saline/alkaline, loamy soils; on nearly level floodplains and low terraces.	Mellor	0-2	VD	Silt loam, fine sandy loam	L	M	Fair to Poor: saline/alkaline	None
150-154	Shabliss-Pober-Genola Association: shallow to very deep, well drained, loamy and very gravelly soils; on fans and lake terraces.	Shabliss	1-5	S	Loam, fine sandy loam over a hardpan	L	L	Poor: quantity	None
		Pober	2-30	MD	Very gravelly loam or sandy loam over a hardpan	L-H	M	Fair: gravels, quantity	None
		Genola	1-5	D	Silt loam, silty clay loam	L	M	Good	None

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
WEST STRAWBERRY VARIATION									
Middle Rock Mountains									
0-6	Borolls-Aquolls Association: very deep, moderately well to poorly drained, loamy and gravelly soils; on nearly level to gently sloping bottomlands.	Borolls	0-5	VD	Loamy and very gravelly	L	L	Fair: gravels	None
		Aquolls	0-5	VD	Loamy and very gravelly	L	L	Fair: gravels	None
6-18	Cryoborolls-Argiborolls Association: deep, well drained, loamy and clayey soils.	Cryoborolls	10-40	D	Clay loam, silty clay loam	M-H	L	Fair to Poor: slope	None
		Argiborolls	10-40	D	Clay loam, clay	M-H	L	Fair to Poor: clayey texture, slope	None
18-27.5 28.3-31	Borolls-Xerolls-Orthents Association: very deep and shallow, well drained, very gravelly and loamy soils; on moderately steep to very steep mountains.	Borolls-Xerolls, gravelly	15-70	VD	Very gravelly and cobbly sandy loam and loam	M-VH	L	Fair to Poor: gravels, cobbles, slope	None
		Borolls-Xerolls, loamy	15-70	VD	Loam to silty clay loam	M-VH	L	Fair to Poor: slope	None
		Borolls-Orthents shallow	15-70	S	Very gravelly and cobbly sandy loam and loam	M-VH	L	Poor: quantity, slope	None
27.5-28.3	Borolls Association: moderately well to poorly drained.	Borolls	0-5	VD	Stratified fine sandy loam to silty clay	L	L	Good	None
31-42	Cryoborolls-Cryoboralfs-Argiborolls Association: moderately deep and deep, loamy and very gravelly soils; on sloping to very steep mountains, ridges and plateaus.	Cryoborolls	5-25	MD-D	Clay loam	L-M	L	Good to Fair: quantity, slope	None
		Cryoboralfs	25-80	MD-D	Clay loam, loam, sandy clay loam	H-VH	L	Fair to Poor: slope, quantity	None
		Argiborolls	25-80	MD	Cobbly or very cobbly clay loam	H-VH	L	Fair to Poor: cobbles, slope, quantity	None
42-43	Argixerolls Association: moderately deep and deep, well drained, very gravelly or cobbly soils; on steep mountains.	Argixerolls	50-80	MD-D	Very gravelly or very cobbly clay loam	VH	L	Poor: slope, gravels and cobbles	None
43-46.5 49.5-51	Fontreen-Lodar-Borvant Association: very deep and shallow, somewhat excessively drained, very gravelly soils; on foothills, ridges, and fans.	Fontreen	4-40	VD	Very gravelly loam	L-H	L	Fair to Poor: gravels, slope	None
		Lodar	8-40	S	Very gravelly loam	L-H	L	Poor: quantity	None
		Borvant	8-40	S	Very gravelly loam over a hardpan	L-H	L	Poor: quantity	None

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
46.5-49.5 51-53.5	Birdow-Keigley-Doyce Association: very deep, well and moderately well drained, loamy soils; on fans, floodplains and alluvial plains.	Birdow	2-8	VD	Loam	L	M	Good	None
		Keigley	2-4	VD	Silty clay loam	L	M	Good	None
		Doyce	2-8	VD	Sandy clay loam and loam	L	L	Good	None
53.5-61	Deer Creek-Bagard-Yeates Hollow Association: very deep, well drained, cobbly and very cobbly soils; on mountain footslopes.	Deer Creek	6-40	BD	Cobbly and stony clay and clay loam	L-H	L	Fair to Poor: cobbles, stones, clayey texture	None
		Bagard	4-40	VD	Very cobbly clay or clay loam	L-H	L	Fair to Poor: cobbles, clayey texture	None
		Yeates Hollow	20-40	VD	Very cobbly clay	M-H	L	Fair to Poor: cobbles, clayey texture	None
61-64.0	Haploxerolls Association: very deep, well drained, loamy and gravelly soils; on fans and terraces.	Haploxerolls	6-15	VD	Loam, gravelly loam	L-M	L	Good to Fair: gravels	None
SALT CREEK CANYON VARIATION									
Basin and Range									
0-1.5	Rofiss-Haploxerolls Association: very deep, well drained, loamy and very gravelly soils; on sloping alluvial fans and terraces.	Rofiss	4-15	VD	Very gravelly clay loam	L-M	L	Fair: gravels	None
		Haploxerolls	4-15	VD	Loam, gravelly loam	L-M	L	Good to Fair: gravels	None
1.5-14.0	Juab-Nephi Association: very deep, well drained, loamy soils; on nearly level to sloping fans and lake terraces.	Juab	0-8	VD	Loam, silt loam	L	M	Good	Some
		Nephi	0-8	VD	Silt loam, silty clay loam	L	M	Good	Some
NORTH LAS VEGAS VARIATION									
Mojave Desert									
0-4.5	Mormon Mesa-Flattop-Arada Association: shallow and very deep, well and somewhat excessively drained, loamy and very gravelly soils; on nearly level to sloping fans and terraces.	Mormon Mesa	0-8	S	Fine sandy loam	L	H	Poor: quantity	None
		Flattop	2-8	MD	Gravelly and very gravelly fine sandy loam over a hardpan	L	L	Fair: quantity, gravels	None
		Arada	0-8	VD	Sand, very gravelly loamy sand	L	H	Poor: sandy texture	None
4.5-8	Badland-Bard-Tonapah Association: shallow to deep, well and somewhat excessively drained, loamy and very gravelly soils, and badland; on dissected terraces and fans.	Badland	15-50	-	----	-	-	----	--
		Bard	2-15	S	Fine sandy loam over a hardpan	L-M	M	Poor: quantity	None
		Tonapah	2-15	VD	Very gravelly sand	L	L	Poor: gravel and sand	None

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
8-9.2 12-12.5	Gila-Toquop-Virgin River Association: very deep, somewhat poorly to excessively drained, saline/alkaline, loamy and sandy soils; on bottomlands and low terraces.	Gila	0-2	VD	Silt loam to fine sandy loam	L	L	Fair to Poor: saline/ alkaline	None
		Toquop	0-2	VD	Fine sand	L	H	Poor: sandy texture	None
		Virgin River	0-2	VD	Stratified clay to sand	L	M	Fair to Poor: saline/ alkaline	Some
9.2-12 12.5-42	Bard-Colorock-Tonapah Association: shallow and deep, well and somewhat excessively drained, loamy and very gravelly soils; on fans and terraces.	Bard	2-15	S	Fine sandy loam over a hardpan	L-M	M	Poor: quantity	None
		Colororck	2-15	S	Very gravelly sandy loam over a hardpan	L-M	L	Poor: quantity	None
		Tonapah	2-15	VD	Very gravelly sand	L	L	Poor: gravel and sand	None
42-43.5 75-77.5 87-88	Rock Land-St. Thomas Association: shallow, well drained, very cobbly soils and rockland, on sloping to steep foothills and mountains.	Rock Land	–	–	----	–	–	----	--
		St. Thomas	10-50	S	Very cobbly loam	M-H	L	Poor: quantity, slope	None
43.5-53 60-66 67-68	Weiser-Dalain Association: very deep, well drained, extremely gravelly soils; on gently sloping to sloping fans.	Weiser	2-8	VD	Extremely gravelly fine sandy loam	L	L	Poor: gravels	None
		Dalain	0-8	VD	Extremely gravelly fine sandy loam	L	L	Poor: gravels	None
53-60 66-67 68-72 73-75 77.5-87	Cave-Las Vegas-Goodsprings Association: shallow, well drained, gravelly and loamy soils; on nearly level to strongly sloping fan remnants.	Cave	0-15	S	Gravelly sandy loam over a hardpan	L-M	M	Poor: quantity	None
		Las Vegas	0-15	S	Fine sandy loam, sandy clay loam over a hardpan	L-M	M	Poor: quantity	None
		Goodsprings	0-15	S	Gravelly fine sandy loam over a hardpan	L-M	M	Poor: quantity	None
72-73	Jean-Arizo Association: very deep, excessively drained, very gravelly soils; on gently sloping to sloping alluvial fans and channels.	Jean	0-4	VD	Very gravelly loamy sand	L	L	Poor: gravels and sand	None
		Arizo	0-8	VD	Very gravelly loamy sand	L	L	Poor: gravels and sand	None
88-109.0	Goodsprings and Ivanpah Valleys: very deep and shallow, well and somewhat excessively drained, very gravelly sandy and loamy soils; on nearly level to moderately steep fans and terraces	Nickel	2-15	VD	Very gravelly sandy loam	L	L	Fair: gravels	None
		Arizo	0-15	VD	Very gravelly loamy sand	L	L	Poor: gravels and sand	None
		Cajon	0-5	VD	Gravelly loamy sand	L	H	Poor: sandy texture	None
		Cave	0-15	S	Gravelly sandy loam over a hardpan	L-M	M	Poor: quantity	None
		Grapevine	0-5	VD	Sandy loam, gravelly sandy	L	M	Good to Fair: saline/ alkaline	None

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)^a	Depth Class^f	Texture^b	Erosion Potential Water^c	Erosion Potential Wind^d	Reclamation Potential Limitations^e	Cropland
HENDERSON VARIATION									
Mojave Desert									
0-0.5	McCarran Association: very deep, well drained, gypsiferous loamy soils; on nearly level alluvial flats.	McCarran	0-4	VD	Gypsiferous sandy loam	L	M	Fair to Poor: salinity, gypsum	None
0.5-6	Caliza-Aztec Association: very deep, well drained, very gravelly soils; on sloping fan terraces.	Caliza	0-8	VD	Very gravelly loamy coarse sand	L	L	Poor: gravel and sand	None
		Aztec	0-8	VD	Very gravelly sandy loam and extremely loamy sand	L	L	Fair to Poor: gypsum, gravels	None
6-7 8-9	Jean-Arizo Association: very deep, excessively drained, very gravelly soils; on gently sloping to sloping alluvial fans and channels.	Jean	0-4	VD	Very gravelly loamy sand	L	L	Poor: gravels and sand	None
		Arizo	0-8	VD	Very gravelly loamy sand	L	L	Poor: gravels and sand	None
7-8 9-15.3	Cave-Las Vegas-Goodsprings Association: shallow, well drained, gravelly and loamy soils; on nearly level to strongly sloping fan remnants.	Cave	0-15	S	Gravelly sand loam over a hardpan	L-M	M	Poor: quantity	None
		Las Vegas	0-15	S	Fine sandy loam, sandy clay loam over a hardpan	L-M	M	Poor: quantity	None
		Goodsprings	0-15	S	Gravelly fine sandy loam over a hardpan	L-M	M	Poor: quantity	None
NORTH BAKERSFIELD VARATION									
Tehachapi Mountains									
0-4 5-7	Steuber-Tehachapi-Havala: very deep, nearly level to hilly, well drained soils on alluvial fans, stream floodplains, and terraces of the mountain valleys.	Steuber	2-9	D	Stony sandy loam, sandy loam	L	M	Good to Fair: stones	Some
		Tehachapi	2-30	D	Loam, sandy loam	L-H	L	Good to Fair: slope	Some
		Havala	0-15	VD	Sandy loam	L-M	M	Good: none	Some
4-5 7-9	Tweedy-Rock Outcrop-Edmundston: outcrop and deep and moderately deep, steep and very steep, well drianed soils underlain by weathered granite or schist; on mountainous uplands.	Tweedy	30-75	MD	Sandy clay loam	H-VH	M	Poor: slope	None
		Rock Outcrop	_	_	_ _ _ _	_	_	_ _ _ _	_ _
		Edmundston	30-75	D	Gravelly sandy loam	H-VH	M	Poor: slope	None
9-20	Walong-Anaverde-Edmundston: very deep to moderately deep, hilly to very steep, well drained soils underlain by weathered granite or schists; on mountainous uplands.	Walong	15-30	MD	Sandy loam	M-H	M	Fair: slope, quantity	None
		Anaverde	30-75	VD	Gravelly loam	H-VH	M	Poor: slope	None
		Edmundston	30-75	D	Gravelly sandy loam	H-VH	M	Poor: slope	None

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
20-33 35.5-36	Sheridan-Anberry Association: moderately deep to deep, hilly to very steep, well drained soils; on hills and mountains.	Sheridan	15-50	MD-D	Sandy loam	M-VH	M	Fair to Poor: slope, quantity	None
		Anberry	15-50	MD-D	Sandy clay loam	M-VH	M	Fair to Poor: slope, quantity	None
San Joaquin Valley									
33-35.5 36-43	Delano-Cuyama Association: very deep, nearly level to sloping, well drained soils; on fans and terraces.	Delano	0-9	VD	Clay loam	L-M	L	Good: none	None
		Cuyama	0-9	VD	Gravelly clay loam	L-M	L	Good to Fair: gravels	None
43-44.5	Xeric Torriorthents, Stratified-Cuyama Association: deep and very deep, gravelly and loamy soils on dissected slopes.	Xeric Torriorthents	9-50	D	Gravelly loamy texture	L-VH	L	Fair to Poor: gravelly, slope	None
		Cuyama	9-15	VD	Gravelly clay loam	L-M	M	Fair to Poor: slope, gravels	None
44.5-45.2	Excelsior Variant-Cajon-Riverwash Association: very deep, loamy and sandy soils on bottomlands, terraces and fans.	Excelsior Variant	0-3	VD	Stratified sand to silt loam	L	L	Fair: sandy texture	Some
		Cajon	0-3	VD	Loamy sand	L	H	Poor: sandy texture	Some
		Riverwash	0-3	VD	Sand and gravel	-	-	----	--
45.2-55 90-111.0	Elkhills-Torriorthents, stratified complex: deep, well drained soils forming in alluvium on dissected uplands.	Elkhills	9-50	VD	Sandy loam, loam	M-VH	L	Good to Poor: slope	None
		Torriorthents	9-50	D-VD	Very gravelly sandy loam	M-VH	L	Fair to Poor: gravels, slope	None
55-78 84-90	Kimberlina Association: deep to very deep, well drained soils forming in alluvium on fans and plains.	Kimberlina	0-5	D-VD	Sandy loam, gravelly sandy loam	L	L	Good: none	Some
78-84	Buttonwillow Association: very deep, somewhat poorly drained soils forming in alluvium.	Buttonwillow	0-2	VD	Clay, fine sandy loam	L	L	Fair: clayey texture	Some
KERN RIVER - EAST LAS VEGAS VARIATION									
Mojave Desert									
0-3 4-8 11-15	Caliza-Aztec Association: very deep, well drained, very gravelly soils, on sloping fan terraces.	Caliza	0-8	VD	Very gravelly loamy coarse sand	L	L	Poor: gravel and sand	None
		Aztec	0-8	VD	Very gravelly sandy loam, and extremely gravelly loamy sand	L	L	Poor: gravel and sand	None
3-4	Land Association: very deep, somewhat poorly drained, loamy soils; on nearly level alluvial flats.	Land	0-2	VD	Silty clay loam	L	L	Fair to Poor: saline/alkaline	None

APPENDIX A CHARACTERISTICS OF THE SOIL MAPPING UNITS THAT WOULD BE TRAVERSED BY THE KERN RIVER PROPOSAL (continued)

Milepost	Soil Mapping Unit	Soil Series	Slope (%)[a]	Depth Class[f]	Texture[b]	Erosion Potential Water[c]	Erosion Potential Wind[d]	Reclamation Potential Limitations[e]	Cropland
8-11	Jean-Arizo Association: very deep, excessively drained, very gravelly soils; on gently sloping to sloping alluvial fans and channels.	Jean	0-4	VD	Very gravelly loamy sand	L	L	Poor: gravels and sand	None
		Arizo	0-8	VD	Very gravelly loamy sand	L	L	Poor: gravels and sand	None
15-80	El Dorado and Piute Valleys: very deep and shallow, well and excessively drained, very gravelly, sandy, and loamy soils; on nearly level to sloping fans	Bluepoint	0-15	VD	Fine sand	L-M	H	Poor: sandy texture	None
		Arizo	4-15	VD	Very gravelly sand	L-M	L	Poor: gravels and sand	None
		Nickel	2-8	VD	Very gravelly sandy loam	L	L	Fair: gravels	None
		Akela	15-50	S	Very gravelly sandy loam	M-H	M	Poor: quantity	None
		McCullough	0-8	VD	Fine sandy loam over sand	L	M	Fair: Sandy texture	None
		Whitlock	4-8	D	Gravelly fine sandy loam	L	M	Good	None
80-104.5	Mojave Valley: deep and shallow, well and somewhat excessively drained, very gravelly, sandy, and loamy soils; on fan terraces	Gunsight	2-35	D	Very gravelly loam	L-H	L	Fair to Poor: very gravelly and stony	None
		Rositas	5-35	D	Sand	L-H	H	Poor: sandy texture	None
		Cipriano	2-10	S	Very stony loam over a hardpan	L-M	L	Poor: quantity, rock fragments	None
		Denure	0-3	D	Gravelly sandy loam	L	M	Good to Fair: sandy texture, gravels	None

[a] Slope range for soil series, pipeline may be on gentler portions of slope range.
[b] Typical textures in soil profile
[c] L(low) = < 5 tons/acre/year
M(moderate) = 5-20 tons/acre/year
H(high) = 20-50 tons/acre/year
VH(very high) = > 50 tons/acre/year
[d] Based on WEG (Wind Erodibility classes): L(low) = 5-8; M(moderate) = 2-4; H(high) = 1-2; or Soil Conservation Service interpretations based on soil mapping unit descriptions.
[e] Based on trenching with no selective soil handling or mitigation.
[f] Soil depth classes:
VS 0-10 inches
S 10-20 inches
MD 20-40 inches
D 40-60 inches
VD 60+ inches

APPENDIX B

KERN RIVER PROPOSAL
VEGETATION COMMUNITY TYPES

VOLUME II APPENDIX B

VEGETATION COMMUNITY TYPE DESCRIPTIONS

Wyoming Basin Region

Forested Lands:

Pinyon-Juniper Woodland. This type occurs at a higher elevation zone above the sagebrush scrub type or on southeast-facing topographic breaks within the sagebrush scrub type. This type is dominated by Rocky Mountain juniper. Similar shrub and understory species occur in this type as described for the sagebrush scrub type. Total vegetal cover ranges from moderate to dense (40-90 percent).

Scrublands:

Mixed Desert Scrub. This community is quite diverse in species composition and may include several dominant shrub species including Gardiner saltbush, four-wing saltbush, shadscale, bud sagebrush, black sagebrush, big sagebrush, winterfat, gray horsebrush, spiny hopsage, and rabbitbrush. Highly alkaline barren areas and bluffs are also included in this type, as well as greasewood along and in dry washes. Typical understory species include bottlebrush squirreltail, Indian ricegrass, needlegrass, western wheatgrass, scarlet gilia, and phlox. Total vegetal cover ranges from barren to moderate (10 to 60 percent).

Sagebrush Scrub. This general type occurs over a wide range of environmental conditions and in several geographic regions. Within the Wyoming Basin and Middle Rocky Mountains, this type occurs at an elevational zone above the mixed desert scrub on well-drained upland soils. The shrub canopy is dominated by big sagebrush and rabbitbrush. Other common shrub species may include snowberry, bitterbrush, and serviceberry. Understory species may include various wheatgrasses, Indian ricegrass, bottlebrush squirreltail, bluegrasses, yarrow, mulesears, phlox, bluebells, and spring beauty. Total vegetal cover ranges from moderate to dense (40 to 90 percent).

Wetland/Riparian:

Wetland/riparian. This community type occurs adjacent to streams and rivers on floodplains within the Wyoming Basin, Wasatch Mountains, and Basin and Range regions. A sub-irrigated or high water table situation exists which is conducive to the growth of hydrophytic species. The surface of the floodplain is often covered by a wet meadow consisting of forbs and graminoids including buttercups, asters, gentians, chickweed, sedges and rushes. This type may include a riparian zone along the streams. Riparian shrubs may include willow, narrowleaf cottonwood, red osier dogwood, stream birch, alder, and bush cinquefoil. This type is often cropped for hay. Total vegetal cover is generally very dense (up to 100 percent).

Agricultural Lands. Within the Wyoming Basin, Wasatch Mountains, and Basin and Range regions, agricultural land primarily consists of irrigated and naturally sub-irrigated meadows or pastures, dryland wheat, and alfalfa.

Middle Rocky Mountains Region

Forested Lands:

Montane Forest. This type includes areas covered by aspen and various species of conifers within the Wasatch Mountains. At lower elevations within this type, Douglas fir and aspen dominate the forest overstory. At higher elevations aspen and Douglas fir are replaced by subalpine fir, Englemann spruce, white fir, lodgepole pine, limber pine, and white bark pine. The structure of this type may vary from a dense forest stand to an open park-like woodland. A wide array of shrubs, forbs, and graminoids may exist below the overstory canopy. Typical shrub species may include snowberry, elderberry, ninebark, and currant. Understory forb and graminoid species may include bluebells, Indian paintbrush, geranium, balsamroot, bluegrasses, pinegrass, and wheatgrasses. Total vegetal cover ranges from moderately dense to very dense (60 to 80 percent).

Mountain Brush. The mountain brush type primarily occurs within the Wasatch Mountains and The Basin and Range region and has an overstory dominated by large shrub to tree-sized species including bigtooth maple, Gambel's oak, mountain mahogany, and serviceberry. Understory shrub species include big sagebrush, bitterbrush, and snowberry. Understory forbs and graminoids may include wheatgrasses, bluegrasses, avalanche lily, bluebells, waterleaf, balsamroot, and yarrow. This type typically occurs above the sagebrush scrub and the pinyon-juniper woodland types. Total vegetal cover typically ranges from moderate to very dense (40 to 100 percent).

Pinyon-Juniper Woodland. This type within this region is very similar to that described under the Wyoming Basin.

Scrublands:

Sagebrush Scrub. This type within this region is very similar to that described under the Wyoming Basin.

VEGETATION COMMUNITY TYPE DESCRIPTIONS

Wetlands/Riparian:

Riverine Wetland. This type within this region is very similar to that described under the Wyoming Basin.

Agricultural Lands:

Agricultural land. Agricultural land within this region is very similar to that described for the Wyoming Basin.

Basin and Range Region

Forested Lands:

Pinyon-Juniper Woodland. This type occurs within the Basin and Range region on mountain blocks at higher elevations above valley floors. The overstory is dominated by Utah juniper with some stands co-dominated by pinyon pine. Horizontal structure within this community may range from dense stands to open park-like woods with shrub, forb, and graminoid species composition similar to the surrounding sagebrush scrub type. Total vegetal cover ranges from moderate to dense (40-90 percent).

Scrublands:

Sagebrush Scrub. Within the Basin and Range region this type includes primarily lower elevation subspecies of big sagebrush and shrub species more typical of lower elevation semideserts. Other co-dominant shrubs include rabbitbrush and Mormon tea. Understory graminoids and forbs include galleta, three-awn, blue grama, buckwheats, lupines, and various species of cacti. Total vegetal cover ranges from moderate to dense (40 to 90 percent).

Mixed Desert Scrub. The mixed desert scrub type in this region is very similar to that described for the Wyoming Basin.

Grasslands:

Utah Grassland. This type occurs in the valleys of Utah within the Basin and Range region, and is dominated by galleta, dropseed, and needlegrass. Several shrub species which are major components of the sagebrush scrub and mixed desert scrub types may be scattered within this type . In addition, forb species typical of surrounding community types also occur within this type. Total vegetal cover ranges from sparse to moderately dense (10 to 80 percent).

VEGETATION COMMUNITY TYPE DESCRIPTIONS

Wetland/Riparian:

Wetland/riparian. This type is very similar to that as described for the Wyoming Basin where the pipeline routes would cross large perennial streams and rivers such as the Jordan and Sevier Rivers of Utah. Narrow riparian zones may occur along intermittent streams and consist of tamarisk, greasewood, and other shrubs described under the Wyoming Basin.

Agricultural Lands:

Agricultural land. Agricultural land that occurs in this region is generally very similar to that described under the Wyoming Basin region.

Mojave Desert Region

Forested Lands:

Joshua Tree Woodland. The Joshua tree woodland community type occurs in an elevational zone just above the Mojavean creosote bush scrub type, and just below the pinyon-juniper woodland type. Joshua tree is the dominant overstory species, but creosote bush and blackbrush may co-dominate in some stands. The community structure and species composition of this type may closely resemble the Mojavean creosote bush scrub type with the exception of the overstory species present. This community type is a unique visual component of the Mojave Desert, and since its distribution is fairly limited, it can be considered sensitive. Total vegetal cover ranges from sparse to moderate (10 to 60 percent).

Scrublands:

Blackbrush Scrub. This type is dominated by blackbrush and occurs at higher elevational zones above Mojavean creosote bush scrub, but below the Joshua tree woodland. Creosote bush and Joshua trees may occur scattered about in this type but not in great significance. Associated species include Spanish bayonet, spiny hopsage, winterfat, bud sagebrush, Mormon tea, and various forbs and graminoids. Total vegetal cover ranges from sparse to moderately dense (10 to 80 percent).

Mojavean Creosote Bush Scrub. Creosote bush dominates this community type and occurs in densities of scattered to abundant. Other common shrubs include bursage, spiny hopsage, turpentine bush, burrobush, shadscale, saltbush and blackbrush. Intershrub

VEGETATION COMMUNITY TYPE DESCRIPTIONS

areas may be quite large with diameters of 50 feet or more. The species composition of this community type varies according to environmental factors such as soil type, soil moisture, and topographic position. Joshua trees may be sparsely distributed at higher elevations and various species of cacti and yuccas may also be sparsely distributed throughout this type. In washes and arroyos, catclaw, palo verde, and ironwood may occur. Understory forbs and graminoids may include Indian ricegrass, galletta, and globe mallow. The relatively sparse intershrub areas may be almost devoid of apparent vegetation during the summer and fall seasons, but if sufficient precipitation occurs in late winter, a rich growth of annuals and perennial plants occurs. Total vegetal cover ranges from very sparse to moderate (0 to 40 percent).

Mojavean Shadscale Scrub. This Mojave Desert community type occurs within the Mojavean creosote bush scrub type in basins and valleys with alkaline soils. Salt tolerant shrub species include shadscale, greasewood, bud sagebrush, winterfat, spiny hopsage, and horsebrush. Characteristic understory species include Russian thistle, seepweed, povertyweed, alkali sacaton, three-awn and bottlebrush squirreltail. Total vegetal cover ranges from very sparse to moderate (0 to 60 percent).

Desert Saltbush Scrub. This community type occurs within the Mojave Desert adjacent to the Mojavean creosote bush scrub type. This type typically occurs along the margins of dry lake beds with terminal drainage. Consequently, the soils are highly alkaline with a high clay content. Generally, a high water table is present, but the soils are rarely saturated on a perennial or intermittent basis. Typical shrub species include several species of saltbush. Total vegetal cover is sparse with little herbaceous cover in the intershrub areas (10 to 20 percent).

Western Mojave Desert Mojave Saltbush Unusual Plant Assemblage. Mojave saltbush dominates this type. Other shrubs, forbs, and graminoids, as well as vegetative structure that typify the Mojavean creosote bush scrub type are also characteristic of this type. This type has been identified as being subject to disturbance, but not as sensitive as other unusual plant assemblages, by the BLM [1980].

Mojavean Juniper Woodland and Scrub. This community type is above and adjacent to the Joshua tree woodland type on the east slopes of the Tehachapi Mountains. This is a transitional type and has several components characteristic of the Joshua tree woodland type as well as a chaparral type. The overstory is dominated by California juniper and Joshua tree. Chaparral species include ceanothus, greasewood, and buckthorn. A large variety of perennial and annual forbs and grasses occur in the understory of this type. Total vegetal cover ranges from moderate to dense (40 to 90 percent).

Wetland/Riparian:

Wetland/riparian. Within the Mojave desert, this type may consist of dry desert washes with scattered shrub species typical of riparian vegetation. Tamarisk is frequently a dominant species which occurs along marginally ephemeral, intermittent, and perennial stream drainages within the Mojave desert. Other co-dominant shrubs may include palo verde, ironwood, mesquite, and desert-willow. Generally this type occurs in narrow bands within the Mojavean creosote bush scrub type. Total vegetal cover ranges from sparse to dense (10-80 percent).

Agricultural Lands:

Agricultural Land. Agricultural land within the Mojave Desert primarily includes alfalfa production and irrigated hay fields.

Tehachapi Mountains Region

Forested Lands:

Digger Pine-Oak Woodland. The digger pine-oak woodland type occurs within the Tehachapi Mountains above and adjacent to the Mojavean juniper woodland and scrub on the east slope, and in an analogous position to the valley and foothill grassland community type on the west slope. This type is characterized by an overstory dominated primarily by blue oak and digger pine. In some areas, valley oak may also be common in an open park-like structure, co-dominating with blue oak and digger pine. Several shrubs characteristic of the chaparral type are common in this type. Numerous species of perennial and annual forbs and grasses, many of which are exotics, occur in this type as a ground cover. Total vegetal cover ranges from moderate to very dense (40 to 100 percent).

Agricultural Lands:

Agricultural land. Within the fertile valleys of the Tehachapi Mountains, the major agricultural land consists of hay meadows, alfalfa fields, vineyards, and orchards.

VEGETATION COMMUNITY TYPE DESCRIPTIONS

Grasslands:

Valley and Foothill Grassland. This community type occurs below the digger pine-oak woodland on the lower foothills on the west slope of the Tehachapi Mountains, in the San Joaquin Valley, and the foothills on the east margin of the coast range. Within the foothills of the Tehachapi Mountains, this type resembles the understory characteristic of the digger pine-oak woodland. Annual species of exotic grasses and forbs have largely replaced the native grasses due to the historic overgrazing in the area. Total vegetal cover ranges from sparse to very dense (10-90 percent).

San Joaquin Valley Region

Wetland/Riparian:

Great Valley Mixed Riparian Forest. This community type is characterized by large winter-deciduous trees with a structure ranging from a dense forest to open park-like woodland. Overstory tree species include primarily valley sycamore, Fremont cottonwood, valley oak, willow, and alder. Large grape vines may utilize these trees for support. A large variety of annual and perennial forbs and grasses cover the ground surface. Total vegetal cover ranges from dense to very dense (90 to 100 percent).

This general class of vegetation also includes tamarisk scrub which commonly lines the margins of ephemeral and intermittent washes and streams within this region.

Grasslands:

Valley and Foothill Grassland. This community type occurs below the digger pine-oak woodland on the lower foothills on the west slope of the Tehachapi Mountains, in the San Joaquin Valley, and the foothills on the east margin of the coast range. Within the San Joaquin Valley, this type has been converted to highly productive cropland or has been urbanized. Valley saltbush scrub and valley sink scrub community types may also occur in isolated locations within the valley and foothill grassland type. Vernal pools also occur within this type which often provide very unique habitats supporting several species of narrow endemics. Along the foothills of the east slope of the coast range, this type is dominated by red foxtail chess and red-stemmed filaree, with saltbush also occurring in varying densities. Total vegetal cover ranges from sparse to very dense (10-90 percent).

Agricultural Lands:

Agricultural lands. Agricultural lands within the San Joaquin Valley are some of the most productive in the world. Major crops in this area include cotton, citrus fruits, grapes, and various truck crops.

APPENDIX C

KERN RIVER PROPOSAL

PLANT SPECIES OF SPECIAL CONCERN

APPENDIX C PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE KERN RIVER MAINLINE, ASSOCIATED COMPONENTS, AND VARIATIONS

Project Component	Geographic Region	Common Name	Scientific Name	Status^{abc}	Community Type	Habitat/ Flowering Time
Kern Mainline	Wyoming Basin	Locoweed	Astragalus jejunus ssp. Nov. (in press)	C2	No data	No data
	Middle Rocky Mtn	Clay phacelia	Phacelia argillacea	LE	Mountain brush	Shaley slopes of the Green River Formation. The known population, which occurs ca 15-20 miles west of the pipeline, occurs on steep unstable shale semi-barrens, mostly with a southerly exposure at ca 6,600 feet. May/June.
		Deseret milk-vetch	Astragalus desereticus	C2	Great Basin sagebrush, Mountain brush	Grows on a minor sandy lens of Tertiary conglomerate on road cuts in the vicinity of Birdseye. Nearest population ca 1/2 to 1 mile away. Late May/June.
	Basin & Range Region	Compact cryptantha	Cryptantha compacta	C2	Mixed desert shrub	Lime, or tuffaceous semi-barrens at 5,000 - 6,500 feet. Nearest population 5-10 miles, west side of Canyon Mtns. May
		Warner's dodder	Cuscuta warneri	C2	Mixed desert shrub	Parasitic on Phyla cuneifolia; an uncommon inhabitant of saline (intermittent) sinks, flats, and low bottom lands nearest population 1-2 miles west. June/August
		Green-gentian	Frasera gypsicola	C1	Great basin sagebrush, Mixed desert shrub	White barren tuffaceous or silty soils (of Lake Bonneville and era abandoned playas) Known only from 2 widely disjunct populations. Mid June/July
		Beardtongue	Penstemon pinorum	C2	Juniper-pinyon woodland	Shade of pinyon and juniper trees, particularly in protected sites along washes between 5,600-5,800 feet elevation, on coarse soil strewn with red basalt and hematite. June
		Gumbo milkvetch	Astragalus ampullarius	C2	Mixed desert shrub Juniper-pinyon woodland	On Chinle and Tropic Shale Formations. Nearest popula- ca 8 miles. April/May

APPENDIX C PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE KERN RIVER MAINLINE, ASSOCIATED COMPONENTS, AND VARIATIONS (continued)

Project Component	Geographic Region	Common Name	Scientific Name	Status[abc]	Community Type	Habitat/ Flowering Time
	Mojave Desert	Desert poppy	Arctomecon californicum	C2	Mojavean creosote bush scrub	Barren, gravelly desert flats, hummocks, and slopes; on tuffaceous sedimentary rocks; often in soil heavily impregnated with gypsum. 1310-2760 elevation. April/May
		Milkvetch	Astragalus geyeri var. triquetrus	C2	Mojavean creosote bush scrub	Sandy places in flats, dunes, washes and gullies, 1500-2500 feet elevation; and annual species of unpredictable distribution - it may appear only in favorable years. April/May
		Catseye	Cryptantha insolita	C2	Mojavean creosote bush scrub, Desert saltbush scrub	Not definitely known, believed from Quaternary alluvium perhaps on saline clay soil with gypsum outcrops. April/June
		Beardtongue	Penstemon bicolor ssp. roseus	C2	Mojavean creosote bush scrub	Sandy, gravelly washes. May/June
		Wild buckwheat	Eriogonum viscidulum	C2 NV-E	Mojavean creosote bush scrub	Sandy soil in washes and flats, an annual whose appearance is sporadic depending on rainfall.
		Rusby globemallow	Sphaeralcea rusbyi ssp. eremicola	C2 CNPS-1(3-2-3)	Mojavean creosote bush scrub	No data. May/June
		Barrel cactus	Ferocactus acanthodes var. acanthodes	C2 CNPS-3(?-3-2-)	Mojavean creosote bush scrub	Gravelly or rocky hillsides canyon walls, alluvial fans and wash margins from 200 to 2000 feet. April/May
		Sand linanthus	Linanthus arenicola	C3c CNPS-2(1-2-1)	Joshua tree woodland	Gypsum soil. Mar/April
		Mojave fish hook cactus	Sclerocactus polyancistrus	C3c CNPS-4(1-2-2)	Mojavean creosote bush scrub	Gravelly mesas and slopes. April/June
		Jaeger milkvetch	Astragulus jaegerianus	C2 CNPS-1(3-1-3)	Mojavean creosote bush scrub, Joshua tree woodland	Dry, stony hillsides and desert mesas. April/June
		Barstow Woolysunflower	Eriophyllum mohavense	C2 CNPS-1(2-2-3)	Mojavean creosote bush scrub	Fine gravelly areas and sandy washes of level or sloping terrain. April/May

APPENDIX C PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE KERN RIVER MAINLINE, ASSOCIATED COMPONENTS, AND VARIATIONS (continued)

Project Component	Geographic Region	Common Name	Scientific Name	Status^{abc}	Community Type	Habitat/ Flowering Time
		Desert cymopterus	Cymopterus deserticola	C2 CNPS-1(3-2-3)	Mojavean creosote bush scrub	Fine to coarse, loose, sandy soil of flats in old dune areas with deep, well drained sand. March/May
		Pholisma	Pholisma arenarium	C2	Mojavean creosote bush scrub	Sandy areas (dunes or sandy washes) Parasitic on roots of shrubs. April/July
		Mojave spineflower	Chorizanthe spinosa	C3c CNPS-4(1-1-3)	Mojavean creosote bush scrub	Sandy washes and flats. April/July.
		Red rock tarweed	Hemizonia arida	C1 CNPS-1(3-2-3) CA-R	Mojavean creosote bush scrub, Tamarisk scrub	Washes along ephemeral seeps and streams and on adjacent sand flats in moist, subalkaline, gravelly sand. April/May
	Tehachapi Mtns.	Fort Tejon yarrow	Erophyllum lanatum var. hallii	C2 CNPS-1(3-2-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Rocky canyon at Fort Tejon between 3500 to 4000 feet. June/July
		Greenhorn calico monkey flower	Mimulus pictus	C3c CNPS-4(1-1-3)	Digger pine-oak woodland	Granite rock outcrops. April/May
		Piute cypress	Cupressus nevadensis	C3c CNPS-4(1-1-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Dry slopes between 4000 to 6000 feet. February/March
		Kern buckwheat	Eriogonum kennedyi var. pinicola	C2 CNPS-1(3-1-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Dry, exposed ridgetops. May/June
	San Joaquin Valley	Comanche Point layia	Layia leucopappa	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Moist benches. March/April
		Bakersfield saltbush	Atriplex tularensis	C1 CNPS-1(3-3-3) CA-E	Valley and foothill grassland	Alkali sinks and alkali plains. June/October
		Bakersfield beavertail cactus	Opuntia basilaris var. treleasei	C1 CNPS-1(3-3-3)	Valley and foothill grassland	On a variety of soil types on low hills adjacent to valley farmlands, mesas and along dry river and stream beds. May
		Hispid bird's-beak	Cordylanthus mollis ssp. hispidus	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Saline flats. June/October

APPENDIX C PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE KERN RIVER MAINLINE, ASSOCIATED COMPONENTS, AND VARIATIONS (continued)

Project Component	Geographic Region	Common Name	Scientific Name	Status^{abc}	Community Type	Habitat/ Flowering Time
		Vaseks clarkia	Clarkia calientensis	C2 CNPS-1(3-1-3)	Valley and foothill grassland	No data
		California jewel flower	Caulanthus californicus	C2 CNPS-3(?-?-3) CA-E	Valley and foothill grassland	Dry plains and slopes below 3000 feet. February/May
		Valley saltbush	Atriplex patula ssp. spicata	C2 CNPS-to common	Valley and foothill grassland	Alkali sinks. April/September
		Tulare Pseudobahia	Pseudobahia peirsonii	C2 CNPS-1(3-3-3) CA-E	Valley and foothill grassland	Adobe soil. March/April
		Congdon's eatonella	Eatonella congdonii	CNPS-4(1-1-3)	Valley and foothill grassland	Alkali sink. March/April
		Hoover's eriastrum	Eriastrum hooveri	C2 CNPS-4(1-1-3)	Valley and foothill grassland	Rolling Plains. April/June
		Slough thistle	Cirsium crassicaule	C2 CNPS-2(2-2-3)	Valley and foothill grassland	Usually on banks of streams, washes sloughs, or canals, moist wet places. June/August
		Coville's navarretia	Navarretia setiloba	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Heavy soils-red gravelly, clay or gravelly loam soils. April/June
		Cottony buckwheat	Eriogonum gossypinum	C2 CNPS-4(2-2-3)	Valley and foothill grassland	On decomposed granite and loamy soils. April/September
		Lost Hills saltbush	Atriplex vallicola	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Dried rainpools and flats. June/August
		Kern mallow	Eremalche kernensis	C2 CNPS-1(2-3-3)	Saltbush scrub	Dry sandy loam soil. April/May
		Striped adobe lily	Frittilaria striata	C2 CNPS-1(3-3-3) CA-T	Valley and foothill grassland to Digger pine-oak woodland	On heavy clay soil. February/April
Kern River Lateral	San Joaquin Valley	Comanche Point layia	Layia leucopappa	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Moist benches. March/April
		Bakersfield saltbush	Atriplex tularensis	C1 CNPS-1(3-3-3) CA-E	Valley and foothill grassland	Alkali sinks and alkali plains. June/October

APPENDIX C PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE KERN RIVER MAINLINE, ASSOCIATED COMPONENTS, AND VARIATIONS (continued)

Project Component	Geographic Region	Common Name	Scientific Name	Status^{abc}	Community Type	Habitat/ Flowering Time
		Bakersfield beavertail cactus	Opuntia basilaris var. treleasei	C1 CNPS-1(3-3-3)	Valley and foothill grassland	On a variety of soil types on low hills adjacent to valley farmlands, mesas and along dry river and stream beds. May
		Hispid bird's-beak	Cordylanthus mollis ssp. hispidus	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Saline flats. June/October
		Vaseks clarkia	Clarkia calientensis	C2 CNPS-1(3-1-3)	Valley and foothill grassland	No data
		California jewel flower	Caulanthus californicus	C2 CNPS-3(?-?-3) CA-E	Valley and foothill grassland	Dry plains and slopes below 3000 feet. February/May
		Valley saltbush	Atriplex patula ssp. spicata	C2 CNPS-to common	Valley and foothill grassland	Alkali sinks. April/September
		Tulare Pseudobahia	Pseudobahia peirsonii	C2 CNPS-1(3-3-3) CA-E	Valley and foothill grassland	Adobe soil. March/April
		Congdon's eatonella	Eatonella congdonii	CNPS-4(1-1-3)	Valley and foothill grassland	Alkali sink. March/April
		Hoover's eriastrum	Eriastrum hooveri	C2 CNPS-4(1-1-3)	Valley and foothill grassland	Rolling Plains. April/June
		Slough thistle	Cirsium crassicaule	C2 CNPS-2(2-2-3)	Valley and foothill Grassland	Usually on banks of streams, washes sloughs, or canals, moist wet places. June/August
		Coville's navarretia	Navarretia setiloba	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Heavy soils-red gravelly, clay or gravelly loam soils. April/June
		Cottony buckwheat	Eriogonum gossypinum	C2 CNPS04(2-2-3)	Valley and foothill grassland	On decomposed granite and loam soils. April/September
		Lost Hills saltbush	Atriplex vallicola	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Dried rainpools and flats. June/August
		Kern mallow	Eremalche kernensis	C2 CNPS-1(2-3-3)	Saltbush scrub	Dry sandy loam soil. April/ May
		Striped adobe lily	Frittilaria striata	C2 CNPS-1(3-3-3) CA-T	Valley and foothill grassland to Digger pine-oak woodland	On heavy clay soil. February/ April

APPENDIX C PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE KERN RIVER MAINLINE, ASSOCIATED COMPONENTS, AND VARIATIONS (continued)

Project Component	Geographic Region	Common Name	Scientific Name	Status^{abc}	Community Type	Habitat/ Flowering Time
Taft Lateral	San Joaquin Valley	Comanche Point layia	Layia leucopappa	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Moist benches. March/April
		Bakersfield saltbush	Atriplex tularensis	C1 CNPS-1(3-3-3) CA-E	Valley and foothill grassland	Alkali sinks and alkali plains. June/October
		Bakersfield beavertail cactus	Opuntia basilaris var. treleasei	C1 CNPS-1(3-3-3)	Valley and foothill grassland	On a variety of soil types on low hills adjacent to valley farmlands, mesas and along dry river and stream beds. May
		Hispid bird's-beak	Cordylanthus mollis ssp. hispidus	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Saline flats. June/October
		Vaseks clarkia	Clarkia calientensis	C2 CNPS-1(3-1-3)	Valley and foothill grassland	No data
		California jewel flower	Caulanthus californicus	C2 CNPS-3(?-?-3) CA-E	Valley and foothill grassland	Dry plains and slopes below 3000 feet. February/May
		Valley saltbush	Atriplex patula ssp. spicata	C2 CNPS	Valley and foothill grassland	Alkali sinks. April/September
		Tulare Pseudobahia	Pseudobahia peirsonii	C2 CNPS-1(3-3-3) CA-E	Valley and foothill grassland	Adobe soil. March/April
		Congdon's eatonella	Eatonella congdonii	CNPS-4(1-1-3)	Valley and foothill grassland	Alkali sink. March/April
		Hoover's eriastrum	Eriastrum hooveri	C2 CNPS-4(1-1-3)	Valley and foothill grassland	Rolling Plains. April/June
		Slough thistle	Cirsium crassicaule	C2 CNPS-2(2-2-3)	Valley and foothill grassland	Usually on banks of streams, washes sloughs, or canals, moist wet places. June/August
		Coville's navarretia	Navarretia setiloba	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Heavy soils-red gravelly, clay or gravelly loam soils. April/ June
		Cottony buckwheat	Eriogonum gossypinum	C2 CNPS04(2-2-3)	Valley and foothill grassland	On decomposed granite and loamy soils. April/September
		Lost Hills saltbush	Atriplex vallicola	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Dried rainpools and flats. June/August
		Kern mallow	Eremalche kernensis	C2 CNPS-1(2-3-3)	Saltbush scrub	Dry sandy loam soil. April/May

APPENDIX C PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE KERN RIVER MAINLINE, ASSOCIATED COMPONENTS, AND VARIATIONS (continued)

Project Component	Geographic Region	Common Name	Scientific Name	Status[abc]	Community Type	Habitat/ Flowering Time
West Strawberry Variation	Middle Rocky Mtn	Clay phacelia	*Phacelia argillacea*	LE	Mountain brush	Shaley slopes of the Green River Formation. The known population, which occurs ca 15-20 miles west of the pipeline, occurs on steep unstable shale semi-barrens, mostly with a southerly exposure at ca 6,600 feet. May/June.
		Sedge fescue	*Festuca dasyclada*	C2	Great Basin sagebrush	Semi-barren gentle slopes of exposed Green River Shale. June
		Deseret milkvetch	*Astragalus desereticus*	C2	sagebrush-juniper and mixed mountain brush comm.	Grows on a minor sandy lens of Tertiary conglomerate on road cuts in the vicinity of Birdseye. Nearest population ca 1/2 to 1 mile away. Late May/June
		Tidestrom beardtongue	*Penstemon tidestromii*	C2	Pinyon-juniper; gambel oak, sagebrush; and desert shrub comm.	Loamy to stony soil at 5400-7200 feet elevation. June
North Las Vegas Variation	Mojave Desert	Desert poppy	*Arctomecon californicum*	C2	Mojavean creosote bush scrub	Barren, gravelly desert flats, hummicks, and slopes; on tuffaceous sedimentary rocks; often in soil heavily impregnated with gypsum. 1310-2760 feet elevation. April/May
		Milkvetch	*Astragalus geyeri* var. *triquetrus*	C2	Mojavean creosote bush scrub	Sandy places in flats, dunes, washes and gullies, 1500-2500 feet elevation; and annual species of unpredictable distribution - it may appear only in favorable years. April/May
		Catseye	*Cryptantha insolita*	C2	Mojavean creosote bush scrub, Saltbush scrub	Not definitely known, believed from Quaternary alluvium perhaps on saline clay soil with gypsum outcrops. April/June
		Beardtongue	*Penstemon bicolor* ssp. *roseus*	C2	Mojavean creosote bush scrub	Sandy, gravelly washes May/June
		Wild buckwheat	*Eriogonum viscidulum*	C2 NV-E	Mojavean creosote bush scrub	Sandy soil in washes and flats, an annual whose appearance is sporadic depending on rainfall.

APPENDIX C PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE KERN RIVER MAINLINE, ASSOCIATED COMPONENTS, AND VARIATIONS (continued)

Project Component	Geographic Region	Common Name	Scientific Name	Status^{abc}	Community Type	Habitat/ Flowering Time
Henderson Variation	Mojave Desert	Desert poppy	Arctomecon californicum	C2	Mojavean creosote bush scrub	Barren, gravelly desert flats, hummocks, and slopes; on tuffaceous sedimentary rocks; often in soil heavily impregnated with gypsum. 1310-2760 feet elevation. April/May
		Milkvetch	Astragalus geyeri var. triquetrus	C2	Mojavean creosote bush scrub	Sandy places in flats, dunes, washes and gullies, 1500-2500 feet elevation; and annual species of unpredictable distribution - it may appear only in favorable years. April/May
		Catseye	Cryptantha insolita	C2	Mojavean creosote bush scrub	Not definitely known, believed from Quaternary alluvium perhaps on saline clay soil with gypsum outcrops. April/June
		Beardtongue	Penstemon bicolor ssp. roseus	C2	Mojavean creosote bush scrub	Sandy, gravelly washes. May/June
		Wild buckwheat	Eriogonum viscidulum	C2 NE	Mojavean creosote bush scrub	Sandy soil in washes and flats, an annual whose appearance is sporadic depending on rainfall.
Kern River North Bakersfield Variation	Tehachapi Mtns.	Fort Tejon yarrow	Erophyllum lanatum var. hallii	C2 CNPS-1(3-2-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Rocky canyon at Fort Tejon between 3500 to 4000 feet. June/July
		Greenhorn calico monkey flower	Mimulus pictus	C3c CNPS-4(1-1-3)	Digger pine-oak woodland	Granite rock outcrops. April/May
		Piute cypress	Cupressus nevadensis	C3c CNPS-4(1-1-3)	Mojavean juniper woodland and scrub Digger pine-oak woodland	Dry slopes between 4000 to 6000 feet. February/March
		Kern buckwheat	Eriogonum kennedyi var. pinicola	C2 CNPS-1(3-1-3)	Mojavean juniper woodland and scrub, Digger pine-oak woodland	Dry, exposed ridgetops. May/June
	San Joaquin Valley	Comanche Point layia	Layia leucopappa	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Moist benches. March/April

Project Component	Geographic Region	Common Name	Scientific Name	Status^{abc}	Community Type	Habitat/ Flowering Time
		Bakersfield saltbush	Atriplex tularensis	C1 CNPS-1(3-3-3) CA-E	Valley and foothill grassland	Alkali sinks and alkali plains. June/October
		Bakersfield beavertail cactus	Opuntia basilaris var. treleasei	C1 CNPS-1(3-3-3)	Valley and foothill grassland	On a variety of soil types on low hills adjacent to valley farmlands, mesas and along dry river and stream beds. May
		Hispid bird's-beak	Cordylanthus mollis ssp. hispidus	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Saline flats. June/October
		Vaseks clarkia	Clarkia calientensis	C2 CNPS-1(3-1-3)	Valley and foothill grassland	No data
		California jewel flower	Caulanthus californicus	C2 CNPS-3(?-?-3) CA-E	Valley and foothill grassland	Dry plains and slopes below 3000 feet. February/May
		Valley saltbush	Atriplex patula ssp. spicata	C2 CNPS-to common	Valley and foothill grassland	Alkali sinks. April/September
		Tulare Pseudobahia	Pseudobahia peirsonii	C2 CNPS-1(3-3-3) CA-E	Valley and foothill grassland	Adobe soil. March/April
		Congdon's eatonella	Eatonella congdonii	CNPS-4(1-1-3)	Valley and foothill grassland	Alkali sink. March/April
		Hoover's eriastrum	Eriastrum hooveri	C2 CNPS-4(1-1-3)	Valley and foothill grassland	Rolling Plains. April/June
		Slough thistle	Cirsium crassicaule	C2 CNPS-2(2-2-3)	Valley and foothill grassland	Usually on banks of streams, washes sloughs, or canals, moist wet places. June/August
		Coville's navarretia	Navarretia setiloba	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Heavy soils-red gravelly, clay or gravelly loam soils. April/June
		Cottony buckwheat	Eriogonum gossypinum	C2 CNPS-4(2-2-3)	Valley and foothill grassland	On decomposed granite and loamy soils. April/September
		Lost Hills saltbush	Atriplex vallicola	C2 CNPS-1(2-2-3)	Valley and foothill grassland	Dried rainpools and flats. June/August
		Kern mallow	Eremalche kernensis	C2 CNPS-1(2-3-3)	Saltbush scrub	Dry sandy loam soil. April/May

APPENDIX C PLANT SPECIES OF SPECIAL CONCERN WHICH MAY OCCUR ALONG THE KERN RIVER MAINLINE, ASSOCIATED COMPONENTS, AND VARIATIONS (continued)

Project Component	Geographic Region	Common Name	Scientific Name	Status^{abc}	Community Type	Habitat/ Flowering Time
		Striped adobe lily	Frittilaria striata	C2 CNPS-1(3-3-3) CA-T	Valley and foothill grassland to Digger pine-oak woodland	On heavy clay soil. February/ April
East Las Vegas Variation	Mojave Desert	Beardtongue	Peustemon bicolor ssp. roseus	C2	Mojavean creosote bush scrub	Sandy, gravelly washes. May/June
		Banel cactus	Ferocactus acanthodes var. acanthodes	C2	Mojavean creosote bush scrub	Gravelly or rocky hillsides, canyon walls, alluvial fans, and wash margins from 200 to 2,000 feet. April/May

[a] Federal candidates and federally listed plants:
LE = Federally listed, endangered
LT = Federally listed, threatened
C1 = Enough data are on file to support the federal listing
C1* = Enough data are on file to support the federal listing presumed extinct
C2 = Threat and/or distribution data are insufficient to support federal listing
C2* = Threat and/or distribution data are insufficient to support federal listing; plant presumed extinct
C3a = Extinct
C3b = Taxonomically invalid
C3c = Too widespread and/or not threatened

[b] State listed plants:
CA-E = California state listed, endangered
CA-T = California state listed, threatened
CA-R = California state listed, rare
NV-E = Nevada state listed, endangered

[c] California Native Plant Society R-E-D Code
R (Rarity)
1 - Rare, but found in sufficient numbers and distributed widely enough that the potential for extinction or extirpation is low at this time.
2 - Occurrence confined to several populations or to one extended population.
3 - Occurrence limited to one or a few highly restricted populations, or present in such small numbers that it is seldom reported.
E (Endangerment)
1 - Not endangered
2 - Endangered in a portion of its range
2 3 - Endangered throughout its range
D (Distribution)
1 - More or less widespread outside California
2 - Rare outside California
3 - Endemic to California

Where CNPS refers to the number list the plant occurs in.
CNPS-1A = Plants presumed extinct in California
-1B = Plants rare and endangered in California and elsewhere
-2 = Plants rare and endangered in California, but more common elsewhere
-3 = Plants about which CNPS needs more information
-4 = Plants of limited distribution (a watch list)

[d] California Department of Fish and Game, Natural Diversity Data Base

SPECIFIC- Represented by a small circle (1/5-mile radius) or bounded area on the overlays. Source information is accurate and detailed, enabling NDDB to map the occurrence within 80 acres of the actual sighting or collection or the element occurs in suitable habitat throughout an area of approximately 80 acres. All bounded areas regardless of size are considered "specific" locations.

NON-SPECIFIC- Represented by a medium circle (1-mile radius on overlays. Source information is not detailed enough for NDDB to map the locality exactly. The actual location is within the circle of 1-mile radius shown on the overlays or the element occurs in suitable habitat throughout an area of approximately 1 mile in radius.

GENERAL- Indicated by large circle (5-mile radius) on the overlays. Source information is only detailed enough for NDDB to map the occurrence within a 5-mile radius or the element perhaps including the entire 5-mile radius shown, but exact boundaries are not known.

[e] Information from the U.S. Fish and Wildlife Service and/or Bureau of Land Management.

APPENDIX D

KERN RIVER PROPOSAL
A SUMMARY OF GRAZING ALLOTMENTS

APPENDIX D A SUMMARY OF LIVESTOCK GRAZING ALLOTMENTS AFFECTED BY THE KERN RIVER PROPOSAL AND ITS VARIATIONS

		GRAZING ALLOTMENTS							PIPELINE						
					Type[3]				Milepost						
State	Administration Agency[1]	Allotment	I.D. Number	Total Acres[2]	Animal	Range	AUMS	AC/AUM	Start	End	Miles Affected	Acres Affected[4]	AUMS Affected	Percent Allotment Affected	Source
Kern River Proposal															
Wyoming	BLM	Carter Lease	1306	257,313	S,C	P	30,798	8.4	0	17	17.0	204	24.3	<.1	Kemmerer Resource Management Plan-BLM
		Albert Creek	1202	39,022	S	P	4,407	8.9	17	28	11.0	132	14.8	.3	" " " " " " " " " " " "
Mainline		Cumberland	1206	459,302	S,C,H	P	66,690	6.9	28	31	3.0	36	5.2	<.1	" " " " " " " " " " " "
		Haystack Draw	1510	7,683	S	P	704	10.9	31	33	2.0	24	2.2	.3	" " " " " " " " " " " "
		Bryne Creek	1505	9,068	S,C	P	284	31.9	33	37	4.0	48	1.5	.5	" " " " " " " " " " " "
		Heinsaw Creek	1507	39,791	S,C	P	1,114	35.7	37	42	5.0	60	1.7	.2	" " " " " " " " " " " "
		Spring Hollow	1509	8,291	S,C	P	228	36.4	42	44	2.0	24	0.7	.3	" " " " " " " " " " " "
		Blake Hollow	1525	6,926	S	P	255	27.2	44	47	3.0	36	1.3	.5	" " " " " " " " " " " "
		Duel	1516	2,594	C	P	52	49.9	47	49	2.0	24	0.5	.9	" " " " " " " " " " " "
		Glosscock Hollow	1513	18,255	S	P	387	47.2	49	51	2.0	24	0.5	.1	" " " " " " " " " " " "
		Coyote Creek	1518	15,273	S,C	P	103	148.3	51	55	4.0	48	0.3	.3	" " " " " " " " " " " "
Utah	USFS	Lake Creek	122	2,564(2469)	S	P	602	4.1	113	115	2.0	24	5.8	0.9	Steve Smith-USFS/Heber
	Heber	Strawberry	149	2,163	S	P	526	4.1	115	117	2.0	24	5.8	1.1	" " " " " " "
		Mill B	134	3,490	S	P	600	5.8	117	119	2.0	24	4.1	0.6	" " " " " " "
		East Daniel	164	18,590	C	P	4,350	4.2	119	123	3.0	36	8.6	0.2	" " " " " " "
		West Daniel	167	10,738	C	P	2,140	5.0	123	124	1.0	12	2.4	0.1	" " " " " " "
		Buck Springs	106	6,242	S	P	733	8.5	124	125	1.0	12	1.4	0.2	" " " " " " "
		Sugar Springs	152	4,837	S	P	660	7.3	Boundary		0.5	6	0.8	0.1	" " " " " " "
	Spanish	Hobble Creek	-	61,563(10732)	C	P	5,400	2.0	125	133	8.0	96	48.0	0.9	Jana Lernback USFS/Spanish Fork
	Fork	Diamond Fork	-	115,039(30170)	C	P	11,640	2.6	133	149	16.0	192	73.8	0.6	" " " " " " " " " "
	BLM	Levan	-	6,790	C	P	700	6.0	191	198	7.0	84	14.0	2.0	Harvy Gates BLM
		Washboard	-	17,908	C	P	3,440	6.0	198	203	5.0	60	10.0	0.3	" " " " "
		Red Butte	-	7,291	C	P	940	6.0	203	206	3.0	36	6.0	0.6	" " " " "
		Blue Springs	-	2,445	C	P	700	6.0	206	208	2.0	24	4.0	0.6	" " " " "
		North Scipio	-	4,890	C	P	762	6.0	208	213	5.0	60	10.0	0.1	" " " " "
		Summit	-	3,752	C	P	261	6.0	221	224	3.0	36	6.0	2.3	" " " " "
		Ephraim Meadow	-	68,128	C	P	3,546	24.0	245	246	1.0	12	0.5	<0.1	Camille Fullmer BLM
		Black Point	-	23,789	C	P	2,165	5.2	251	258	7.0	84	16.1	0.7	" " " " " "
		Twin Peak	-	186,570	C	P	8,645	13.0	262	271	9.0	108	8.3	<0.1	" " " " " "
		East Antelope	-	18,721	C	P	544	33.0	271	272	1.0	12	0.4	<0.1	" " " " " "
	USFS	West Pinto	-	27,066	C	P	1,584	4.8	360	367	7.0	84	17.5	1.0	
	Dixie	Megotsu	-	31,159	C	P	1,576	8.3	367	374	7.0	84	10.1	<.6	
	BLM	Mineral Wash	-	4,838	C	-	254	19.0	376	379	3.0	36	1.9	.7	-
	Dixie	Twin Peak	-	31,504	C	-	1,175	26.8	379	385	6.0	72	2.7	.2	-
		Desert Inn	-	41,507	C	-	1,488	27.9	385	388	3.0	36	1.3	<.1	-
		Jackson Wash	-	32,210	C	-	1,519	21.2	389	396	7.0	84	4.0	.3	-
		Scarecrow Peak	-	47,290	C	-	2,033	23.4	396	401	5.0	60	2.6	.1	-
		Terry	-	30,163	C	-	2,366	12.7	401	407	6.0	72	5.6	.2	Dane McDonald BLM/St George

APPENDIX D A SUMMARY OF LIVESTOCK GRAZING ALLOTMENTS AFFECTED BY THE KERN RIVER PROPOSAL AND ITS VARIATIONS (continued)

GRAZING ALLOTMENTS									PIPELINE						
State	Administration Agency[1]	Allotment	I.D. Number	Total Acres[2]	Type[3] Animal	Range	AUMS	AC/AUM	Milepost Start	End	Miles Affected	Acres Affected[4]	AUMS Affected	Percent Allotment Affected	Source
Nevada	BLM	George Springs	-	101,125	S,C	E	3,458	29.2	407	419	12	144	4.9	.1	Rick Orr per communication
		Beacon	-	5,682	S	E	419	13.6	419	423	4	48	3.5	.8	" " " " " " " "
		Sand Hollow	-	35,174	S,C	E	2,430	14.5	423	428	2	24	1.7	<.1	" " " " " " " "
		Toquop Sheep	-	29,793	S	E	393	75.8	428	435	7	84	1.1	.3	Clark County Grazing EIS, 1982
		Upper Morman Mesa	-	47,659	C	E,P	779	61.2	435	446	11	132	2.2	.3	J. Peiffer per communication
		Glendale	-	22,353	C	E	None	-	446	447	1	12	-	-	" " " " " " " " "
		Mesa Cliff	-	14,072	C	E	139	101.2	447	448	1	12	0.1	<.1	" " " " " " " " "
		Muddy River	-	20,081	C	E	None	-	448	457	9	108	-	-	" " " " " " " " "
		Muddy Mountains	-	243,170	C	E,P	207	1174.0	460	483	23	276	0.2	<.1	" " " " " " " " "
		Hidden Valley	-	69,436	C	E,P	445	156.0	507	514	7	84	0.5	<.1	" " " " " " " " "
		Jean Lake	-	137,217	C	E,P	3,529	38.9	514	529	15	180	4.6	<.1	" " " " " " " " "
		Table Mountain	-	92,269	C	E,P	174	530.3	529	530	1	12	0.02	<.1	" " " " " " " " "
		Roach Lake	-	14,986	C	E,P	292	51.3	529	536	7	84	1.6	<.1	" " " " " " " " "
California	BLM	Clark Mountain	39	88,312	C	E,P	1,872	47.2	536	550	14	168	3.5	<.1	California Desert Conservation Plan, 1980
		Valley Wells	51	237,258	C	E,P	4,848	48.9	550	571	21	252	5.1	<.1	" " " " " " " " " " " " " "
		Cronese Lake	42	51,000	C	E	1,019	50.0	596	615	19	228	4.6	<.1	" " " " " " " " " " " " " "
		Superior Valley	33	167,648	S	E	2,247	74.6	627	647	20	240	3.2	<.1	" " " " " " " " " " " " " "
		Harper Dry Lake	27	12,816	C	E,P	740	17.3	650	654	4	48	2.8	<.1	" " " " " " " " " " " " " "
		Baron Sheep	22	4,714	S	E	157	30.0	662	681	19	228	7.6	.2	" " " " " " " " " " " " " "
Kern River Wasatch Variation															
Utah	USFS Wasatch	Arthur Fork	-	3,800	S	P	480	7.9	Boundary		2	24	3.0	<.1	Jim Cook per communication
		Shingle Mill	-	1,000	S	P	51	19.6	Boundary		2	24	1.2	.1	" " " " " " " "
		Mill Canyon	-	2,600	S	P	60	43.3	116A	117A	1	12	0.3	<.1	" " " " " " " "
Kern River West Strawberry Variation															
Utah	Heber	Sugar Springs		4,837	S	P	660	7.3	124	126	2	24	3.3	<.1	Steve Smith per communication
		Mud Creek - Cattle		6,096 (5936)	C	P	1,849	3.3	126	127	1	12	3.6	<.1	" " " " " " " " " "
		Mud Creek-Sheep		3,163 (2777)	S	P	783	3.5	127	129	2	24	6.9	.2	" " " " " " " " " "
		Bryants Fork		2,685 (2538)	S	P	744	3.4	129	132	3	36	10.6	.4	" " " " " " " " " "
		Squaw Creek		2,179	S	P	720	3.0	132	134	2	24	8.0	.4	" " " " " " " " " "
		North Streeper		2,734 (2567)	S	P	616	4.2	134	135	1	12	2.9	.1	" " " " " " " " " "
		Ludlow		2,181	S	P	633	3.4	136	137	1	12	3.5	.2	" " " " " " " " " "
		Chipman		2,745 (2725)	S	P	578	4.7	137	139	3	36	7.7	.3	" " " " " " " " " "
		Davis		5,638 (4145)	S	P	1,000	4.1	139	140	1	12	2.9	<.1	" " " " " " " " " "
	USFS Spanish Fork	Diamond Fork		115,039(30170)	C	P	11,640	2.6	140	145	5	60	23.1	<.1	

GRAZING ALLOTMENTS									PIPELINE						
State	Administration Agency[1]	Allotment	I.D. Number	Total Acres[2]	Type[3] Animal	Range	AUMS	AC/AUM	Milepost Start	End	Miles Affected	Acres Affected[4]	AUMS Affected	Percent Allotment Affected	Source
	USFS Manti-LaSal	Clear Creek		6,458 (3847)	S	P	1,068	3.6	Boundary		6	72	20.0	.5	Bob Thompson,
		Driveway		1,627 (1352)	S	P	176	7.7	Boundary		1	12	1.6	.1	Leland Matheson per communication
		Lake Fork		34,357 (9008)	C	P	2,856	3.2	Boundary		2	24	7.6	<.1	" " " " " " " " " "
		Mountain Lion		8,230 (5935)	S	P	1,150	5.2	151	152	1	12	2.3	<.1	" " " " " " " " " "
		Poisen Ridge		3,985 (3528)	S	P	914	3.9	152	154	2	24	6.2	.2	" " " " " " " " " "
		Jones Ridge		8,498 (7186)	S	P	1,585	4.5	154	159	5	60	13.2	.2	" " " " " " " " " "
Kern River East Las Vegas Variation															
Nevada	BLM	River Mountain		10,371	-	-	None	-	502	504	2	24	-	-	Clark County Grazing EIS
		Ireteba Peaks		344,607	C	E,P	1,849	186.3	504	543	39	468	2.5	<.1	" " " " " " " "
		Christmas Tree Pass		89,255	C	E	3,711	24.1	543	557	14	168	7.0	<.1	" " " " " " " "
		South Point		22,998	C	E	216	106.5	557	566	9	108	1.0	<.1	" " " " " " " "
Kern River North Las Vegas Variation															
Nevada	BLM	Upper Morman Mesa		47,659	C	E,P	779	61.2	442	446	4	48	.8	<.1	Clark County Grazing EIS
		Glendale		22,353	C	E	*None	-	446	451	5	60	-	-	" " " " " " " "
		Ute		90,280	C	E	107	656.8	451	454	3	36	<.1	<.1	" " " " " " " "
		Dry Lake		69,399	C	E	199	348.7	467	482	15	180	.5	<.1	" " " " " " " "
		Spring Mountain		310,364	-	-	**None	-	509	526	17	204	-	-	" " " " " " " "
		Table Mountain		92,269	C	E,P	174	530.3	526	538	12	144	.3	<.1	" " " " " " " "
		Roach Lake		14,986	C	E,P	292	51.3	538	541	3	36	.7	<.1	" " " " " " " "
Kern River North Bakersfield Variation															
California	BLM	Naval Petro 3		1,518	S	E,P	253	6.0	795	796	1	12	2.0	.1	Coast Valley Planning Area EIS
		Naval Petroleum		2,278	S	E,P	380	6.0	796	797	1	12	2.0	<.1	(Ken Volpe per communication)
		Powerline Road		215	S	E,P	36	6.0	797	798	1	12	2.0	.9	" " " " " " " " " "

[1] PVT = private land; BLM = Bureau of Land Management; BIA = Bureau of Indian Affairs; STATE = State Lands
[2] Includes BLM, state and private land in an allotment; total acres (suitable acres).
[3] S = sheep; C = cattle; H = horse; P = permenant range; E = ephemeral range; NI = information not readily available.
[4] Calculated at 12 acres/mile of pipeline.
*Not grazed due to presence of desert tortoise.
**Not grazed due to presence of desert tortoise and bighorn sheep.

APPENDIX E

E-1 PLANT SPECIES LIST

E-2 COMMON AND SCIENTIFIC NAMES FOR WILDLIFE SPECIES

APPENDIX E-1

COMMON AND SCIENTIFIC NAMES FOR PLANT SPECIES

Common Name	Scientific Name
Trees and Shrubs	
Alder	Alnus spp.
Aspen	Populus tremuloides
Big tooth maple	Acer grandidentatum
Big sagebrush	Artemisia tridentata
Bitterbrush	Purshia tridentata
Black sagebrush	Artemisia nova
Blackbrush	Coleogyne ramosissima
Blue oak	Quercus douglasii
Broom snakeweed	Gutierrezia sarothrae
Buckbrush	Ceanothus spp.
Buckthorn	Rhamnus californica
Bud sagebrush	Artemisia spinescens
Burrobush	Hymenoclea salsola
Bursage	Ambrosia dumosa
Bush cinquefoil	Potentilla fruticosa
California juniper	Juniperus californica
Catclaw	Acacia gregii
Ceanothus	Ceanothus spp.
Cottonwood	Populus spp.
Creosote bush	Larrea tridentata
Currant	Ribes spp.
Desert willow	Chilopsis linearis
Desert saltbush	Atriplex spp.
Digger pine	Pinus sabiniana
Douglas fir	Pseudotsuga menziesii
Elderberry	Sambucus coerulea
Engelmann spruce	Picea engelmanni
Four-wing saltbush	Atriplex canescens
Fremont cottonwood	Populus fremontii
Gambel's oak	Quercus gambelii
Gardner saltbush	Atriplex gardineri
Grape	Vitis spp.
Gray horsebrush	Tetradymia spp.
Greasewood	Sarcobatus vermiculatus
Honey mesquite	Prosopis glandulosa
Horsebrush	Tetrademia spp.
Ironwood	Olneya tesota
Joshua tree	Yucca brevifolia
Juniper	Juniperus spp.
Limber pine	Pinus flexilis
Lodgepole pine	Pinus contorta
Mesquite	Prosopis spp.
Mojave saltbush	Atriplex spinifera
Mormon tea	Ephedra spp.

APPENDIX E-1 (continued)

COMMON AND SCIENTIFIC NAMES FOR PLANT SPECIES

Common Name	Scientific Name
Trees and Shrubs (continued)	
Mountain mahogany	*Cercocarpus montanus*
Narrowleaf cottonwood	*Populus angustifolia*
Ninebark	*Physocarpus* spp.
Oak	*Quercus* spp.
One-seeded juniper	*Juniperus monosperma*
Oregon ash	*Fraxinus latifolia*
Palo verde	*Cercidium floridum*
Pinyon pine	*Pinus edulis*
Rabbitbrush	*Chrysothamnus* spp.
Red osier dogwood	*Cornus stolonifera*
Rocky Mountain juniper	*Juniperus scopulorum*
Sagebrush	*Artemisia* spp.
Saltbush	*Atriplex* spp.
Seepweed	*Suaeda* spp.
Serviceberry	*Amelanchier* spp.
Shadscale	*Atriplex confertifolia*
Snowberry	*Symphoricarpos* spp.
Spiny hopsage	*Grayia spinosa*
Stream birch	*Betula occidentalis*
Subalpine fir	*Abies lasiocarpa*
Tamarisk	*Tamarix* spp.
Turpentine bush	*Thamnosma montana*
Utah juniper	*Juniperus osteosperma*
Valley oak	*Quercus lobata*
Valley sycamore	*Platanus racemosa*
White bark pine	*Pinus albicaulis*
White fir	*Abies concolor*
Willow	*Salix* spp.
Winterfat	*Ceratoides lanata*
Succulents	
Bakersfield beavertail cactus	*Opuntia basilaris* var. *treleasei*
Cholla	*Opuntia* spp.
Prickly pear cactus	*Opuntia* spp.
Spanish bayonet	*Yucca baccata*
Yucca	*Yucca* spp.
Forbs and Grasses	
Alfalfa	*Medicago sativa*
Alkali sacaton	*Sporobolus airoides*
Aster	*Aster* spp.

APPENDIX E-1 (continued)

COMMON AND SCIENTIFIC NAMES FOR PLANT SPECIES

Common Name	Scientific Name
Forbs and Grasses (continued)	
Avalanche lily	*Erythronium* *grandiflorum*
Bakersfield saltbush	*Atriplex* *tularensis*
Balsamroot	*Balsamorhiza* spp.
Blue grama	*Bouteloua* *gracilis*
Bluebell	*Mertensia* spp.
Bluegrass	*Poa* spp.
Bottlebrush squirreltail	*Sitanion* *hystrix*
Bromegrass	*Bromus* spp.
Buckwheat	*Eriogonum* spp.
Buttercup	*Ranunculus* spp.
California jewel flower	*Caulanthus* *californicus*
Chickweed	*Stellaria* spp.
Clay phacelia	*Phacelia* *argillacea*
Comanche point layia	*Layia* *leucopappa*
Cotton	*Gossypium* spp.
Deseret milkvetch	*Astragalus* *desereticus*
Desert cymopterus	*Cymopterus* *deserticola*
Dropseed	*Sporobolus* spp.
Dryland wheat	*Triticum* spp.
Fescue	*Festuca* spp.
Galletta grass	*Hilaria* *jamesii*
Geranium	*Geranium* spp.
Globe mallow	*Sphaeralcea* spp.
Green gentian	*Gentiana* *frasera*
Indian ricegrass	*Oryzopsis* *hymenoides*
Indian paintbrush	*Castilleja* spp.
Jaeger milkvetch	*Astragalus* *jaegerianus*
Locoweed	*Astragalus* *jejunus*
Lupine	*Lupinus* spp.
Mulesears	*Wyethia* spp.
Needlegrass	*Stipa* spp.
Phlox	*Phlox* spp.
Pinegrass	*Calamagrostis* *rubescens*
Povertyweed	*Monolepis* *nuttalliana*
Red foxtail chess	*Bromus* *rubens*
Red rock tarweed	*Hemizonia* *arida*
Red-stemmed filaree	*Erodium* *cicutarium*
Rush	*Juncus* spp.
Russian thistle	*Salsola* *kali*
Scarlet gilia	*Ipomopsis* *aggregata*
Sedge	*Carex* spp.
Spring beauty	*Claytonia* *lanceolata*
Striped adobe lily	*Fritillaria* *striata*

APPENDIX E-1 (continued)

COMMON AND SCIENTIFIC NAMES FOR PLANT SPECIES

Common Name	Scientific Name
Forbs and Grasses (continued)	
Three-awn	Aristida spp.
Tulare pseudobahia	Pseudobahia peirsonii
Waterleaf	Hydrophyllum spp.
Western wheatgrass	Agropyron smithii
Wheatgrass	Agropyron spp.
Wild buckwheat	Eriogonum viscidulum
Wild oat	Avena spp.
Yarrow	Achillea millefolium

APPENDIX E-2

COMMON AND SCIENTIFIC NAMES FOR WILDLIFE SPECIES

Common Name	Scientific Name
Fish	
Black bullhead	Ictalurus melas
Bluegill	Lepomis macrochirus
Bonneville cutthroat trout	Salmo clarki utah
Brook trout	Salvelinus fontinalis
Brown trout	Salmo trutta
Carp	Cyprinus carpio
Channel catfish	Ictalurus punctatus
Cutthroat trout	Salmo clarki
Fathead minnow	Pimephales promelas
Largemouth bass	Micropterus salmoides
Leatherside chub	Gila copei
Longnose dace	Rhinichthys cataractae
Moapa dace	Moapa coriacea
Moapa river speckled dace	Rhynichthys osculus moapae
Moapa roundtail chub	Gila robusta spp.
Moapa white river springfish	Crenichthys baileyi moapa
Mosquitofish	Gambusia affinis
Mottled sculpin	Cottus bairdi
Mountain sucker	Catostomus platyrhynchus
Mountain whitefish	Prosopium williamsoni
Rainbow trout	Salmo gairdneri
Red shiner	Notropis lutrensis
Redside shiner	Richardsonius balteatus
Speckled dace	Rhinichthys osculus
Striped bass	Morone saxatilis
Utah sucker	Catostomus ardens
Utah chub	Gila atraria
White catfish	Ictalurus catus
Birds	
American kestrel	Falco sparverius
Bald eagle	Haliaeetus leucocephalus
Black-tailed gnatcatcher	Polioptila melanura
Black-throated sparrow	Amphispiza bilineata
Blue grouse	Dendragapus obscurus
Brewer's sparrow	Spizella breweri
Burrowing owl	Athene cunicularia
Bushtit	Psaltriparus minimus
Cactus wren	Campylorhynchus brunneicapillus
California quail	Callipepla californica

APPENDIX E-2 (continued)

COMMON AND SCIENTIFIC NAMES FOR WILDLIFE SPECIES

Common Name	Scientific Name
Birds (cont)	
California condor	Gymnogyps californianus
Canada goose	Branta canadensis
Chukar	Alectoris chukar
Clark's nutcracker	Nucifraga columbiana
Cooper's hawk	Accipiter cooperi
Ferruginous hawk	Buteo regalis
Gambel's quail	Callipepla gambelii
Golden eagle	Aquila chrysaetos
Great horned owl	Bubo virginianus
Horned lark	Eremophila alpestris
Long-billed curlew	Numenius americanus
Long-eared owl	Asio otus
Merriam's turkey	Meleagris gallopavo
Mountain plover	Charadrius montanus
Mountain quail	Oreortyx pictus
Northern harrier	Circus cyaneus
Northern goshawk	Accipiter gentilis
Peregrine falcon	Falco peregrinus
Pine siskin	Spinus pinus
Prairie falcon	Falco mexicanus
Pygmy owl	Glaucidium gnoma
Red-tailed hawk	Buteo jamaicensis
Ring-necked pheasant	Phasianus colchicus
Roadrunner	Geococcyx californianus
Rock wren	Salpinctes obsoletus
Ruffed grouse	Bonasa umbellus
Rufous-sided towhee	Pipilo erthrophthalmus
Sage sparrow	Amphispiza belli
Sage grouse	Centrocerus urophasianus
Sandhill crane	Grus canadensis
Screech owl	Otis kennecottii
Scrub jay	Aphelocoma coerulescens
Sharp-shinned hawk	Accipiter striatus
Short-eared owl	Asio flammeus
Swainson's hawk	Buteo swainsoni
Tricolored blackbird	Agelaius tricolor
Verdin	Auriparus flaviceps
Western snowy plover	Charadrius alexandria nivosus
Western yellow-billed cuckoo	Coccyzus americanus occidentalis
White-faced ibis	Plegadis chihi
White-tailed (Mississippi) Kite	Ictinia mississippiensis
Whooping crane	Grus americana

APPENDIX E-2 (continued)

COMMON AND SCIENTIFIC NAMES FOR WILDLIFE SPECIES

Common Name	Scientific Name
Mammals	
Badger	Taxidea taxus
Black bear	Ursus americanus
Black-footed ferret	Mustela nigripes
Blacktail jackrabbit	Lepus californicus
Bobcat	Lynx rufus
Coyote	Canis latrans
Desert cottontail	Sylvilagus auduboni
Desert woodrat	Neotoma lepida
Desert bighorn sheep	Ovis canadensis mexicana
Elk	Cervus canadensis
Feral horse	Equus spp.
Giant kangaroo rat	Dipodomys ingens
Kit fox	Vulpes macrotis
Longtail weasel	Mustela frenata
Mojave ground squirrel	Spermophilus mohavensis
Moose	Alces alces
Mountain lion	Felis concolor
Mule deer	Odocoileus hemionus
Nelson's antelope squirrel	Ammospermophilus nelsoni
Porcupine	Erethizon dorsatum
Pronghorn antelope	Antilocapra americana
Richardson ground squirrel	Citellus richardsoni
San Joaquin pocket mouse	Perognathus inoratus inoratus
San Joaquin kit fox	Vulpes macrotis mutica
Short-nosed kangaroo rat	Dipodomys nitratoides brevinasus
Snowshoe hare	Lepus americanus
Striped skunk	Mephitis mephitis
Tehachapi pocket mouse	Perognathus alticola inexpectatus
Tipton kangaroo rat	Dipodomys nitratoides nitratoides
Utah prairie dog	Cynomys parvidens
White-tailed prairie dog	Cynomys gunnisoni
Wild burro	Equus asinus
Amphibians and Reptiles	
Blunt-nosed leopard lizard	Gambelia silus
Coachwhip	Masticophis flagellum
Desert iguana	Dipsosaurus dorsalis
Desert tortoise	Gopherus agassizii
Gila monster	Heloderma suspectum

APPENDIX E-2 (continued)

COMMON AND SCIENTIFIC NAMES FOR WILDLIFE SPECIES

Common Name	Scientific Name
Amphibians and Reptiles (continued)	
Gopher snake	Pituophis melanoleucus
Rattlesnake	Crotalus spp.
Sagebrush lizard	Sceloporus graciosus
Side-blotched lizard	Uta stansburiana
Tehachapi slender salamander	Batrachoseps stebbinsi
Western whiptail	Cnemidophorus tigris
Zebra-tailed lizard	Callisaurus draconoides
Invertebrates	
Hopping's blister beetle	Lytta nitidicollis
Moestan's blister beetle	Lytta moesta
Moleston's blister beetle	Lytta spp.
Morrison's blister beetle	Lytta morrisoni

APPENDIX F

ENERGY TRANSPORTATION AND UTILITY CORRIDOR PLANNING DIRECTION

APPENDIX E-2 (continued)

COMMON AND SCIENTIFIC NAMES FOR WILDLIFE SPECIES

Common Name	Scientific Name
Amphibians and Reptiles (continued)	
Gopher snake	*Pituophis melanoleucus*
Rattlesnake	*Crotalus spp.*
Sagebrush lizard	*Sceloporus graciosus*
Side-blotched lizard	*Uta stansburiana*
[illegible]	[illegible]
Western whiptail	*Cnemidophorus tigris*
Zebra-tailed lizard	*Callisaurus draconoides*
Invertebrates	
Hopping's blister beetle	*Lytta hoppingi*
Molestan's blister beetle	*Lytta molesta*
Moestan's blister beetle	*Lytta spp.*
Morrison's blister beetle	*Lytta morrisoni*

ENERGY TRANSPORTATION AND UTILITY CORRIDOR PLANNING DIRECTION

UTAH NATIONAL FORESTS
LAND AND RESOURCE MANAGEMENT PLANS

KERN RIVER NATURAL GAS PIPELINE
PRIMARY ROUTE AND VARIATIONS

Introduction

Section 6 of The Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA), as amended by the National Forest Management Act of 1976 (NFMA), requires the development, maintenance, and revision of a land and resource management plan for each National Forest. Additional guidance for preparation of these plans is provided by NFMA regulations (CFR 219 Subpart A) and the Forest Service Manual (FSM 1950). The regulations require each Forest Plan be accompanied by an Environmental Impact Statement which meets the requirements the Council on Environmental Quality (CEQ) regulations and the requirements of the National Environmental Policy Act of 1969 (NEPA) and its implementing regulations.

Status of Forest Plans for the concerned Utah National Forests

1. Uinta and Wasatch-Cache National Forests - Final Forest Plans in effect.

2. Dixie and Manti-LaSal National Forests - Final Forest Plans in 45 day review period and subject to appeal.

3. Fishlake National Forest - Portions of the Forest Plan under appeal but does not affect Kern River Proposal.

Preparation of Forest Plans has been coordinated with related planning efforts of other federal agencies, state and local governments, Indian tribes, and concerned public and private groups. Power marketing agencies and public and private utilities were involved in the development of standards and guidelines used in the planning process to formulate alternatives and to select the final location and designation of energy transportation and utility corridors. Alternatives took into consideration regional and state land-use policies, environmental quality, economic efficiency, regional security, safety, good engineering and technological practices, and recommendations from concerned agencies and utilities.

Each Forest Plan has management direction and standards and guidelines governing the use and development of National Forest System lands within designated utility corridors as well as lands outside these corridors. No activity or use can be permitted which does not meet Plan requirements. Procedures prescribed in the NFMA regulations must be followed when considering plan amendment to accommodate nonconforming project proposals.

Locations of The Kern River Natural Gas Pipeline Project with Regard to Designated Utility Corridors on National Forest System Lands (Primary Route and Variations)

Primary Route - On the Dixie National Forest, this route is within the proposed Newcastle-Veyo corridor/window. It is not within a designated corridor on the Uinta National Forest. At the present time this route does not cross the Fishlake National Forest. However, if the route were moved to the east or west of Scipio Pass (up to one mile), the route would be within the proposed Scipio Pass corridor on the Forest.

Strawberry Variation - This route is not within any designated utility corridor on National Forest System lands affected.

Wasatch Variation - Two of the 5.3 miles on the Wasatch-Cache National Forest are within the designated Ward Canyon corridor. The remaining 3.3 miles are not within a designated corridor.

Management Direction and Standards and Guidelines

Linear Right-of-Way Proposals within Proposed or Designated Corridors - Corridor width, types of facilities permitted, preferred locations within corridors, and protection of sensitive resources are prescribed. With appropriate mitigation, the portions of the primary route and variations within designated corridors can be made consistent with Forest Plan requirements.

Linear Right-of-Way Proposals Outside of Proposed or Designated Corridors -

Primary Route and West Strawberry Variations on the Uinta National Forest

The Forest Plan specifies the right-of-way will be located:

1. Within an identified existing corridor.
2. Outside of classified wilderness, scenic areas, or roadless areas.
3. Outside of commercial Forest System land.
4. One-half mile or more from areas of concentrated recreation.
5. In areas where permanent road access to facilities would not be needed through winter game range.
6. Where excavation for pipelines or road access would not pass through areas with soil characteristics which make the area prone to soil slump or mass wasting.
7. Where visual quality objectives (VQO) are maintained, i.e., outside of "Retention" VQO areas; inside of "Partial Retention" VQO areas with a high visual absorption capability; or inside of areas with "Modification" VQO with a moderate to high visual absorption capability.

The pipeline, as proposed, is inconsistent with Forest Plan requirements as follows:

Primary Route - The route is not within a designated corridor on the Forest. Twelve miles cross unstable slopes with slump or mass wasting soil characteristics. Ten miles cross through areas having a Recreation Opportunity Spectrum (ROS) classification of semiprimitive nonmotorized. (A pipeline route will change this classification.) The pipeline route will open the area to off-road vehicle use. (The area is presently closed to such use.) Visual quality objectives are not met on approximately 17 or the 27.7 miles on the Forest.

West Strawberry Variation - The route is not within a designated corridor on the Forest. Eleven miles cross unstable slopes with slump or mass wasting soil characteristics. Five miles cross through areas having a ROS classification of semiprimitive nonmotorized; again, a pipeline route will change this classification and will open the area to off-road vehicle use. Approximately two miles of the route cross within 1/2 mile or less of the Strawberry Recreation Area, i.e. an area of concentrated recreation. Visual quality objectives are not met on approximately 13 of the 33.4 miles on the Forest.

West Strawberry Variation on the Manti-LaSal National Forest

The Forest Plan provides a context for evaluating new energy transmission facilities by designating corridors, unclassified areas, exclusion areas, and avoidance areas.

Designated Corridors. Widths of corridors, resource concerns, and types and location of facilities within corridors are addressed. General direction requires energy right-of-way proponents to consider designated corridors as alternatives in their application for right-of-way authorization. Designated corridors must also be considered as alternatives in the NEPA process for energy transmission proposals.

Unclassified areas. Energy right-of-way proposals will be evaluated using the direction and standards and guidelines for the affected management areas. Generally, linear right-of-way proposals in these areas will not create unavoidable adverse consequences. These areas are usually not contiguous across any particular portion of the Forest and do not lend themselves to route planning.

Exclusion areas. Statutory requirements prohibit authorization of facilities in these areas.

Avoidance Areas. Energy right-of-way proposals will be evaluated and analyzed on a case-by-case basis, according to the direction and standards and guidelines for the affected management areas.

Management decisions in these areas are guided by the analysis and evaluation of proposals and compliance to the standards and guidelines for natural, social, and physical resource values.

The variation is inconsistent with Forest Plan requirements. The conflicts are as follows:

1. This variation is not located within a designated corridor. The area traversed by the proposed route was considered for possible designation as a corridor during preparation of the Forest Plan. This alternative was rejected during the NEPA process because of significant unavoidable environmental impacts and overall public concern.

2. Approximately 7 of the 10 miles on the National Forest cross through an unclassified areas. All areas outside of existing travelways in this area are closed to off-road vehicle use, and cannot be effectively closed to such use.

3. Approximately 2 of the 10 miles cross through an avoidance area.

   a. The pipeline route in this area will not avoid steep to very steep terrain with unstable slopes and soils prone to slumping or mass wasting. Pipeline construction and operation may adversely affect old landslides and/or cause new slope instability and increase soil erosion.

   b. All areas outside of existing travelways in the avoidance area are closed to off-road vehicle travel. The pipeline route will open up the area to off-road vehicle use, and cannot be effectively closed to such use.

   c. Within the avoidance area, the pipeline route will descend a steep to very steep slope that is highly visible from Highway 89. This slope has a visual quality objective of Partial Retention. It may not be feasible to maintain this objective because of cost and complexity of mitigation needed.

Wasatch Variation on the Wasatch-Cache National Forest

The Forest Plan provides a context for evaluating new energy transmission facility proposals by the use of designated corridors, exclusion areas, and avoidance areas. (Management implications for these classifications are the same as those discussed in the above section for the West Strawberry Variation on the Manti-LaSal National Forest.

The variation is inconsistent with Forest Plan requirements. The conflicts are as follows:

1. This variation is within the designated Ward Canyon corridor for two miles. The remaining 3.3 miles on National Forest Land are outside the corridor.

2. The 3.3 miles cross through an avoidance area.

   a. In this area, steep to very steep terrain will be crossed by the pipeline. The terrain is highly susceptible to land slides and debris flows and has experienced severe land movement in the recent past. Pipeline construction and operation may add to or cause new land stability and soil erosion problems.

   b. This segment is also located in the Mill Creek municipal watershed for Bountiful City. Construction on unstable slopes or soils may adversely affect water quality.

   c. This segment has an ROS classification of semiprimitive nonmotorized. Construction of the pipeline will change this classification. This area is presently closed to off-road vehicle use. Experience has shown it is very difficult to prevent such use once a pipeline is completed.

   d. This segment will cross within 0.1 mile of a heavily used recreation site. Pipeline construction and operation may adversely affect the present landscape and user activities at this site.

   e. The Retention VQO in the Mill Creek drainage will be difficult to maintain where the variation crosses three recreation hiking trails. Costly and detailed mitigation will be required to keep the pipeline route from being visually evident from the trails. Portions of the pipeline route may be visually evident from heavily traveled highways. Again, costly and detailed mitigation will be required to maintain the specified VQOs of Retention and Partial Retention.

Primary Route on the Dixie National Forest

The location of the primary route through the Dixie National Forest will have to be coordinated with the Forest, Intermountain Power Agency, Utah Power and Light Company, Utah Associated Municipal Power Systems, and other concerned utilities. This coordination will take into consideration proper location of utilities, mitigation measures, and the conflicts of use that could occur within the Newcastle-Veyo corridor.

Summary

The segments of the primary route and variations outside of proposed and designated utility corridors are not consistent or only partially consistent with Forest Plan. Proposed mitigation does not meet all requirements of the standards and guidelines for these ares.

Unavoidable adverse impacts remain for slope stability, soil erosion, recreation opportunity spectrum classifications, and visual quality within the primary route and West Strawberry Variation on the Uinta National Forest. These were the same findings of the EIS for the Forest Plan. This EIS evaluated several alternatives for a north-south utility corridor across the Forest and found each alternative to be incompatible with public issues dealing with the impacts mentioned above.

Unavoidable adverse impacts remain for slope stability, soil erosion, and off-road vehicle management on the West Strawberry Variation across the Manti-LaSal National Forest. The potential exists for unavoidable adverse impacts to the established VQO for a portion of the variation on the National Forest.

Unavoidable adverse impacts remain for slope stability, soil erosion, and the recreation opportunity spectrum on the Wasatch Variation across the Wasatch-Cache National Forest. The potential exists for unavoidable adverse impacts to the established VQO for the variation on the National Forest.

NRMA does not preclude the Forest Service from considering inconsistent project proposals which would require amendment of a Forest Plan. However, Forest Plan amendments will only be considered when all of the following items have a positive finding in the NEPA process and the Federal Energy Regulatory Commission certification process:

The pipeline is found to be a legitimate use of National Forest System land.

The Kern River project is shown to be essential to public welfare and is needed to meet increased local, regional, or national demand for oil recovery or other energy requirements, or is shown to result in a substantial increase in net public benefits.

The Kern River project is shown to be the best alternative.